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Materials Handling

Electrical Methods Considered Essential

FOR some time now the *Electrical Review* has endeavoured to clarify for its readers the background to the new phase of industrial production—the quick and efficient handling of materials, and to drive home the idea that this should be viewed as a process and not merely as a necessary evil between processes.

The phase is almost revolutionary in this country, because the sudden demand for output, increasing to an extent for which manufacturers were not prepared, has resulted in a break in the evolutionary progress of the past few years during which gradual development has been along the lines of mass production, line flow, production continuity, mechanisation, etc., each of which terms possessed, with modifications according to the varying production conditions, its own particular meaning.

The Dominant Factor

Production engineers have had, and are having, to work to an unprecedented programme governed by materials handling whilst still possessing an outlook which subordinates materials handling to processes. Within a limited view it is putting the cart before the horse, but the wider aspect is that present-day exigencies have created a position which is readily submitted to solely in the interests of production. It is necessary to arrest this line of thought here lest we become involved in higher economics and probably politics ; but it is equally necessary to follow the line to this point if we are to view the important subject of materials handling in its true perspective.

To illustrate our point we publish in this issue a description of the most advanced scheme of materials handling we have so far seen, a foundry installation by which the ratio of the weights of materials handled to the castings produced has been reduced from say, 275 to 1 to 120 to 1. These are remarkable and compelling figures, and in whatever direction or to whatever conclusion our line of thought may lead, they cannot be ignored by production and electrical engineers.

Electricity and Industrial Progress

" Why electrical engineers ? " it may be asked. Many electrical engineers are, of course, production engineers, but we are more concerned at the moment with the wider influence of electrical engineering on industrial progress generally. The new materials-handling phase could certainly have not been brought about without modern electrical aid.

The modern drive alone is essential to any scheme of materials handling comparable to those we have in mind. We have already pointed to such developments as the steelworks motor, the self-contained hoist, the portable electric crane and the electric truck, as all contributing to that flexibility of operation which is essential. But the keynote to any installation designed to produce maximum production is flexibility of control, and to ensure this in the full sense electric control is the only possible means. Even if other control

methods are employed they are subordinated to a master electrical control. Sequence control, the logical and ultimate governing feature of modern materials handling is essentially electrical.

Superannuation Ruling

As some doubt exists regarding the position of power station engineers under the Essential Work Order when they reach superannuation age, the Man-Power Consultative Committee of the electricity supply industry recently sought enlightenment on the subject. The Ministry of Labour has ruled that when a man reaches the age for compulsory retirement he will be given permission by the National Service Officer to leave his employment, but if his employers wish to retain him he will be asked to continue. In the case of a man who becomes eligible to retire before the "compulsory" age, permission to leave will not be granted.

Remuneration Questions

IN reporting this matter the *Electrical Power Engineer* says that the practice with regard to the remuneration of men who are retained in this way varies as between undertakings. Some employees receive only their normal salary and some are paid 50 per cent. of their superannuation allowance as well. It has been maintained that they should receive full salary and full superannuation allowance and the E.P.E.A. and other bodies are considering the matter with a view to making representations to the Government.

Science in Industry

A SUBJECT in which the late Llewelyn B. Atkinson was keenly interested, *viz.*, industrial research, was appropriately chosen by Dr. P. Dunsheath as the theme of his Memorial Lecture. The most important of his constructive proposals was perhaps that relating to means to shorten the usually prolonged discovery - invention - application period. This may be artificially lengthened, often quite justifiably, but sometimes to an extent that is unnecessary. A co-ordinating body such as he advocates (see our report on a later page) should do much towards improving the patent position. If the difficulties of getting industry to set up its own organisation are insurmountable, then Dr. Dunsheath's suggestion for a public service corporation similar to the B.B.C. would appear best to meet the requirements.

Factory Requisitioning

IN the High Court last week Mr. Justice Hilbery decided that No. 51 (1) of the General (Defence) Regulations empowered a "competent authority" to requisition a factory if it appeared to that authority that it was necessary or expedient to do so, and that the Court had no power to inquire whether there was a good or sufficient ground for the decision. The action was taken by a food products company against the Commissioners of Works, the Minister of Food and the Minister of Labour and National Service.

In Camera

WE are becoming accustomed to secret sessions and cleared Courts necessitated by considerations of national security. Security of another kind was given as the reason for hearing a case *in camera* recently. The action concerned an electric burglar alarm and it was feared that if evidence were given in open court any burglars present would pick up some useful tips about the alarm, which would cause despondency among its users. It is to be hoped that the working of this "secret weapon" will remain a mystery to unauthorised entrants.

Power Station Problems

IN this issue we present the arguments advanced by Mr. T. H. Carr in favour of an I.E.E. Generation Section, the formation of which he suggested in a letter published by us last week. Two papers read so far this Session and a third yet to come would have provided very suitable topics for such a Section. There are, moreover, always a number of special problems relating to the design and operation of items of power-station equipment that need ventilation by open discussions.

Electrical Efficiency

MORE than a temporary significance should be attached to the remarks of Major R. H. Rawll in opening the discussion by the I.E.E. Installations Section on the use of electricity in relation to fuel economy. Apart from the temporary sacrifice of some comfort and convenience that the war

entails, it is essential at all times to healthy electrical development that not a kWh more shall be used than is necessary for any specific purpose. This saves coal and also encourages extended adoption of electrical methods. It should be a supply undertaking's normal duty to help existing consumers to economise as well as to add to their number.

Value of Service

FEW signs of agreement as to the basic form of domestic tariff most suitable as a national standard were discernible in the I.E.E. discussion last week. There was more general recognition of the truth of Mr. P. Schiller's contention regarding the impracticability of allocating all the standing costs of supply to the standing-charge component of existing two-part tariffs. Even if this were otherwise, such a course would be generally unacceptable to users of electricity. In emphasising the importance of value of service rather than cost of supply, Mr. C. T. Melling was only paying due regard to the preferences of consumers, which will be the deciding factor in the long run.

A National Tariff?

CONSUMERS should not be asked to concern themselves with costs, which are the affair of supply undertakings in their balancing of revenue and expenditure. Without departing too far from the Hopkinson principle, it is legitimate to merge standing and running charges, as in the block tariff advocated by Mr. Harold Hobson in opening the discussion. This form of tariff is easily understood and encourages the use of electricity. It would also appear to offer possibilities of general application which other tariffs apparently do not. It seems probable that the last consideration will have weight in the near future.

Fresh Air

REGARDING the broadcast suggestion that ingress and egress of air into or from rooms should be prevented as much as possible in the interests of fuel economy, doubts have been expressed as to the hygienic aspects. Actually, the physiological need is for moving air rather than for a renewal of air (which seldom becomes appreciably vitiated). The main function of fresh air is to reduce excessive temperatures and to provide convection currents, due to temperature differences, which enliven the atmosphere. Desirable motion may be imparted to the air in other ways, *e.g.*, by electric fans and by some types of electric heater. The air can be changed when the heating system is not in use.

Gas-filled Transformers

WITH the aim of saving oil for insulating transformers in the United States (where upwards of 44 million gallons are estimated to be in use for the purpose) investigations are being carried out, the *Electrical World* states, into the possibilities of compressed nitrogen. Heat runs and power-frequency dielectric tests on a 50-kVA, 2,400/240-V single-phase transformer operating at 150 lb. per sq. in. are considered to have proved the practicability of the method. As the impulse characteristics of compressed gases are inferior to those of oil, it is questionable whether these would be suitable at high voltages. Also the overall cost of the transformer unit would, no doubt, be more.

Lamp Restrictions

IT comes as something of a revelation that although recent restrictions upon the number of types of electric lamps made in the United States are said to have reduced the range by more than half, the schedule of permitted types still lists about 1,700 incandescent lamps and thirteen "fluorescents." The reduction is effected mainly by cutting down the number of voltages and wattages for which lamps are made. For instance, household lamps will now be made only for 115, 120 and 125 V; there will be no 110 and 130-V lamps. Likewise 50- and 75-W lamps will be eliminated, and three colours only will be available.

Trouble Ahead

As though we haven't enough trouble already, we are warned by Dr. W. Gleissberg, of the University of Chicago, that 1948 will be a troublesome year for electric power and telecommunication authorities. This is because that year will be marked by abnormal sunspot occurrence, probably the greatest for over a hundred years. The result will be widespread interference with power transmission and communication systems. Let us hope that by 1948 we shall have overcome Nazi interference and be free to attend to this other matter.

A Generation Section?

Keeping Abreast of Modern Developments

By T. H. Carr, A.M.Inst.C.E., A.M.I.Mech.E., A.M.I.E.E.

ON looking through the programme for the second half of the present session of the Institution of Electrical Engineers one is confronted with the problem of deciding which papers or meetings are likely to be of special interest from a personal point of view. Being interested in power station practice and development, I ask myself "Why is there no Generation Section?"

Logically, the existing sections—Transmission, Installations, Wireless and Measurements—should all have followed a "Generation" Section. Any young electrical engineer particularly interested in electric power generation may wonder why a Section devoted to so important a subject has not been formed by the Institution.

Admittedly, the inception of the grid system by the Act of 1926 eliminated many of the existing smaller stations and this no doubt has affected the general opinion of engineers interested or likely to be interested in electric power production. Nevertheless, technical developments in the remaining stations have been extremely rapid. Some idea of their extent may be gathered from a typical station in which the plant capacity increased from four 700-kW 100-RPM sets in 1901 to four 50,000-kW 1,500-RPM sets in 1935.

The theme during the years 1930-39 was distribution and sales, but the present conflict has brought to notice again the importance of generation. Generation is the root of the "electrical tree," and unless it receives the nourishment it rightly needs its fruit is likely to fall short of expectations.

Ample Material

It may be argued that there is little of general interest to the industry in generation, and a few may suggest that the companion Institutions—Civils, Mechanicals and Fuel—cater for the majority of power plant problems and developments. With the latter view I agree, but surely it is the duty of the I.E.E. to keep its members abreast of all modern power station developments. Free exchange of ideas is facilitated by combined meetings, but a Generation Section would stimulate further interest in this important branch of the industry. That ample material is available for free and frank discussion is evident by the inauguration by the C.E.B. of periodical meetings of power station superintendents in at least one area. Latterly station chemists have also been included so that full co-operation may be facilitated in tackling the problems met with in practice.

The principal features which could come up for discussion would in general fall under one or more of the following headings: Development and design; construction and layout; operation and maintenance.

That there is a need for a Generation Section may be further brought out by one recent example. A paper by Mr. F. Favell which dealt with the selection of Power Station Sites appeared in the *Journal* of the I.E.E. during the past year and, in my opinion, was worthy of bringing to the notice of all engineers and others connected with, or interested in, electric power supply. Had it not been for an editorial in the electrical Press,* I doubt whether adequate attention would have been directed to it. The selection of sites for power stations will be one of the major problems in post-war planning, and I feel that more publicity could have been given to such an important contribution by discussion before a Generation Section.

Coal Conservation

Next, there is the ever important factor of conservation of coal, and it is here that power-station engineers will be required to co-operate with the manufacturers in designing and constructing the requisite generating plant in order to secure the highest economy.

Finality in design is never reached, and it is hoped that improvement will continue as knowledge of materials and other factors increases. The development of hydro-electric schemes to augment the output of base-load steam plants should also be kept in mind. If we retain our present-day plants there will be much room for improvement, especially in regard to boiler-house and coal and ash-handling plants.

Another important problem for discussion is the selection and training of power-station technical staffs and operatives, to which much more attention should be given. Some undertakings suffer very much from the limited choice of operatives, and no amount of training will improve matters.

In these days of rapid electrical development the power station is probably the most important part of an undertaking. The interconnection of a number of stations tends to reduce the relative importance of any one of them, but we must not lose sight of the inconveniences resulting from its failure.

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* See *Electrical Review* of September 15th.

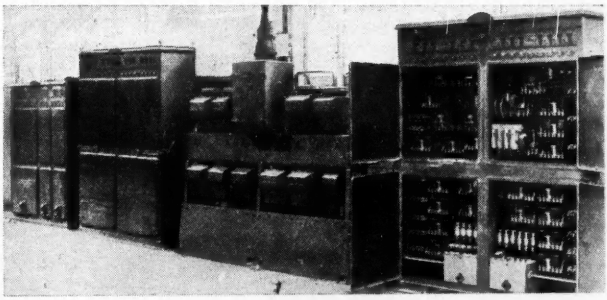
Mechanised Foundry

Flexible Materials Handling System

THE ratio of the total weight of materials handled to the weight of the actual castings produced in the non-mechanised type of foundry with which most of our readers are familiar may reasonably be put at 275 to 1. In a Rolls-Royce light-alloys factory which, so far as our experience goes, is the last word in the application of materials handling, from the modern production point of view, the ratio is 120 to 1. These figures alone will probably do more to create the desirable outlook with regard to recent revolutionary changes on production practice in which materials handling is a governing feature than will the explanations we have hitherto been able to offer.

Flexibility of operation and control is obviously the keynote to the design of this particular installation in which every provision appears to have been made to safeguard the continuity of production throughout. The layout is planned to afford a continuous flow of raw materials from the railway siding at one side of the foundry through their various stages of production to the delivery of the finished castings at the other side.

Electrically the outstanding feature of the scheme is the provision of sequence control of all the essential conveyors, elevators and machines in the production line, and weight is added to this contention by the fact that the sequence control scheme is non-automatic and the equipment is of the simplest possible character. The motors are individually controlled by push-buttons which operate contactors at a central station, and on each contactor there is a subsidiary circuit so arranged that any subsequent circuit remains "broken" until the contactor for the preceding equipment is closed. The motors can thus only be started up in the order of production.



The outstanding feature of the scheme is sequence control for the essential conveyors, etc.; in the illustration the sequence control and distribution panels are shown

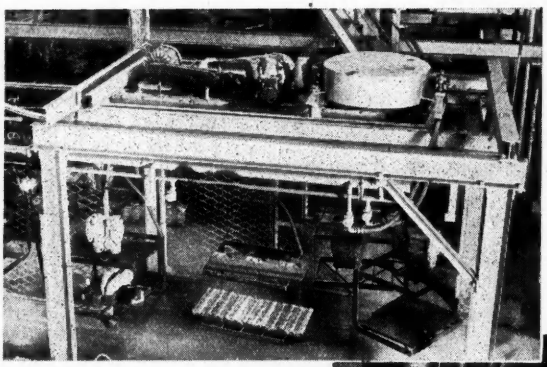
For the purpose of sequence control the plant is sectionalised as follows: A, sand from the hoppers to the moulding bays; B, return sand group; C, core sand distribution; D, new sand from the trucks to the hoppers; E, sand drying plant. It will not be necessary to do more than mention in the following description of the scheme to which sequence some of the more important equipments belong.

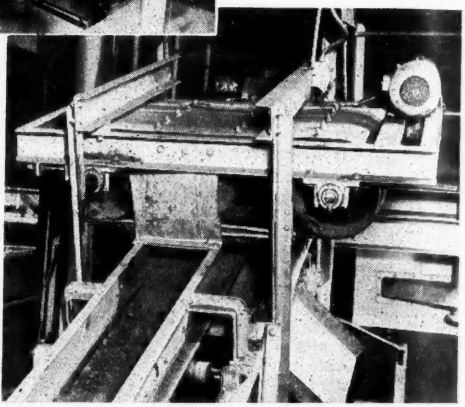
Moulding and core sands are delivered from rail trucks through a grid at the floor level outside the foundry and then passed, in turn, through a rotary table feeder, a bucket elevator and belt conveyor to the storage hoppers. These three equipments are individually driven by 3- or 4-HP motors through a reduction gear with a ratio of about 30 to 1. They are all on sequence D. The sand is next dealt with by a large horizontal sloping rotary dryer at the rate of 4 to 5 tons per hour. This dryer is on sequence E, and it is rotated at 3 RPM by means of a 5-HP motor with transmission through reduction gear on to a rack on the periphery of the drum. Combustion air is provided to the gas burner by a 1-HP motor-driven fan. An air-lift system deposits the dried and cooled sand into large storage hoppers.

Predetermined quantities of the sand are gravity fed from the hoppers into the core-sand mixers immediately below. These mixers have local starters and each is driven by a 9-HP motor through a 50 to 1 reduction gear. After a thorough mixing with various binding agents the sand is discharged to the coremakers' benches where the operatives indicate by warning lights to the distribution platform above when further supplies of sand are required. The indicating system is simply a number of 3·5-V lamps supplied from a separate transformer and wired for two-way switching. Steel-band conveyors up to 170 ft. long transport the cores from the coremakers' benches to the core stoves, the lower strand of the conveyor being used for the return of the coreplates to the benches. These conveyors have local starters and are

driven by a 3-HP motor with 500 to 1 gear box transmission.

The coke-fired core stoves are each of the vertical internal-conveyor type and the cores are taken up one side and down the other of the continuous conveyor on swivelling trays arranged as the links of the conveyor. The conveyor is driven by a 3-HP, 1,500-RPM motor with transmission *via* a double-reduction gear box and chains. The cores take 2¼ hours to pass through the stove, which has local control. The motor and transmission gear are mounted externally high up on the stove wall. Another drive on each core stove is a 1-HP, 1,500-RPM motor directly coupled to a centrifugal fan providing combustion air. This is push-button controlled locally and is not on the sequence system.

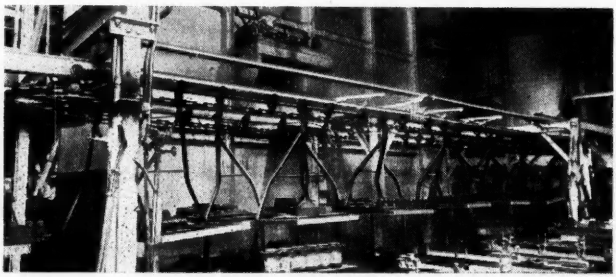




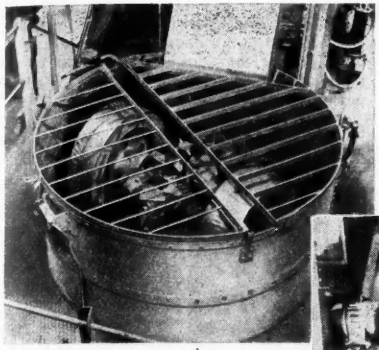
The baked cores are carried from the stoves to the core stores on pendulum conveyors; above is shown driving gear mounted on a table at the conveyor end At one point (right) the refuse sand conveyor passes under a magnetic separator

The baked cores are carried from the stoves to the core stores on pendulum conveyors, but en route they are removed for trimming and inspection and replaced on the conveyor, which also passes through a drying tunnel. There is a particularly interesting transmission scheme for each pendulum conveyor, the gear being mounted on a table above and at one end of the conveyor. From the 1½-HP, 750-RPM motor there is transmission by chain to a right-angle gear box and then a coupling through bevel gearing to the crown wheel of the conveyor. The conveyor speed is 3 ft. per min. The control is not on the sequence system, local direct-on starters being employed.

Various natural bonded sands for moulding are received at and distributed in the foundry in a manner similar to that for the core sands, and they are treated in five-tons-per-hour batch mixers. These each have internal vertical rollers which revolve against a horizontal table and are driven by a vertical shaft from a 15-HP motor below through a 50 to 1 ratio reducing gear box. These mixers are also not on the sequence control, but the motors are remotely operated



The driving motor for the conveyor in the core stove is mounted high up on the stove wall outside; pendulum conveyor in foreground

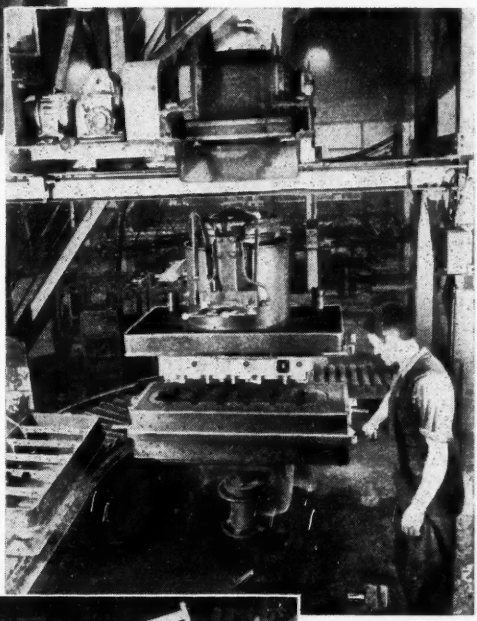


The grid covers of the moulding sand mixers are electrically interlocked with the motor circuit

from the sequence control panels. There is also local push-button emergency control. Hinged grid covers on each mixer are electrically interlocked with the motor control circuit, so that the machines cannot be run up with the covers open.

The sand from the batch mixers is fed downwards by way of motor-driven distribution tables on to a 5-HP motor-driven inclined belt conveyor which feeds on to the main conveyors running the full length of the foundry. Ploughs on these belts control the sand to the hoppers at the moulding stations. The motor driving the conveyors is rated at 10 HP at 1,000 RPM, driving through a reduction gear of 100 to 3 ratio. Control of the flow of sand from each overhead hopper into the machine is effected by foot operation of the motor driving a short conveyor belt which receives sand from the hopper and drops it into the machine. In this way the machine moulder retains both hands free for placing the chills and spreading the incoming sand during the operation of the machine.

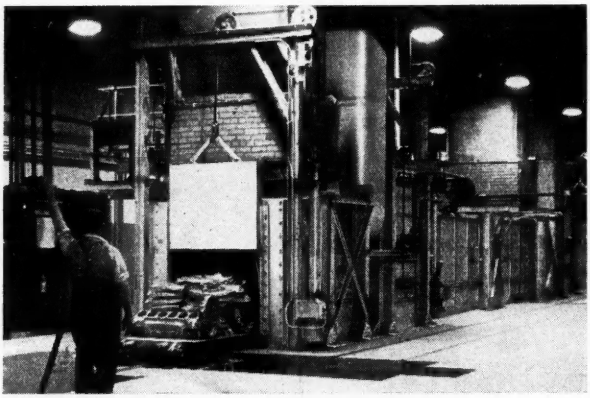
The moulding machines are compressed-air operated on the jolting principle and some of them are fitted with an electrically driven timer which shuts off the solenoid valve in the air



Above: The moulding machines are compressed - air operated on the jolting principle and by foot-switch control the operator governs the overhead sand feeder

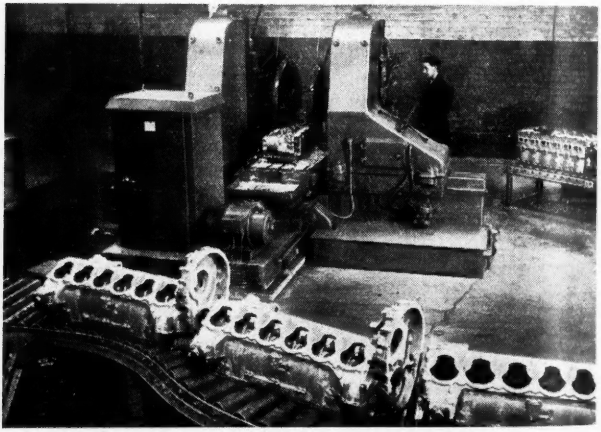
Left : Flexibility of operation and control is the keynote to the design of the foundry installation

line after a predetermined number of jolts. The timer consists of a small shaded-pole motor driving through a gear train on to a threaded spindle. As the threaded spindle revolves a nut travels along it until it engages a lever which actuates an arm carrying a number of contacts. The timing interval is determined by the distance through which the nut has to travel. This distance can be pre-set. When the contacts operate, a solenoid clutch disengages the drive from the motor and allows the nut to return to its starting point under the influence of a spring, leaving the timer ready for a further operation.



There is fine limit switch control for the pusher gear and the doors of the heat treatment furnace

The prepared cores and moulds meet in the moulding bay where the molten metal for casting is received from oil-fired tilting furnaces, combustion air for which is provided by two motor-driven directly-coupled centrifugal blowers on the roof. The motors are remotely controlled from a point adjacent to the furnaces.



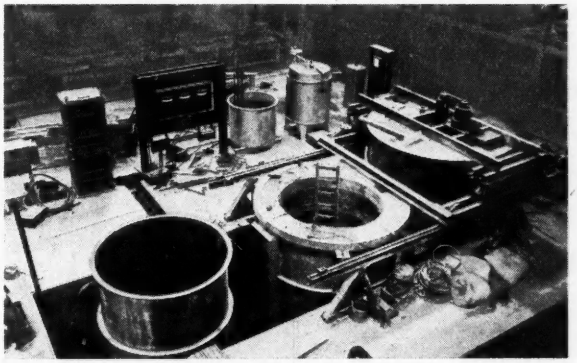
A dual finishing saw has AC saw drive and DC feeder drive

After the actual "pouring" the moulding sand is passed through grids in the floor and returned to the sand plant for reconditioning on an underground conveyor driven by an 8-HP, 750-RPM motor with a double reduction gear to give a belt speed of 19·6 ft. per min. This conveyor is on control sequence B. The floor knockout section is equipped with an air suction system which extracts from the foundry over 70,000 cu. ft. of air per minute to render the section dust-free. With control on sequence B, the fan of the suction system is directly coupled to a 40-HP motor.

The castings are treated in the finishing section where the refuse core sand is first removed and allowed to fall through grids on to a locally controlled motor-driven conveyor which removes the sand to outside hoppers ready for disposal. At one point this conveyor passes under a magnetic separator consisting of two rollers, one of which is motor driven, constituting the drum pulleys of a short continuous belt. On the belt are rows of iron studs at about 6-in. intervals. Within the belt path, *i.e.*, between the drums, are two electromagnets which are supplied with DC by metal rectifiers housed in the sequence-control panels. The belt studs are thus magnetised when they pass through the magnetic field and at this point they are on the bottom

strand about 6 in. above the sand conveyor belt, so that any tramp iron which is in the sand is attracted and held to the studs until these pass out of the magnetic field. At this point the studs on the belt are at the outer point of the periphery of one drum and the tramp iron falls off into a collecting hopper.

The castings are passed on to band or circular saws which remove the runners and risers. The most interesting driving scheme associated with this equipment is that relating to each of the dual circular saws. An AC motor driving each saw wheel is incorporated in the machine, while the feeding table is served by a 2-HP DC motor which is supplied by a three-phase mercury arc rectifier housed in the control cubicle adjacent to the machine. An auxiliary electrode which keeps the rectifier energised when it is switched off also provides field current for the motor. Current control in the armature circuit is provided by grid control of the rectifier; this provides a fine variable-speed scheme. A manually operated induction regulator controls the grid circuit of the rectifier and hence the output. The table moves in the forward (cutting) direction at a speed determined by the induction regulator. At the end of the forward stroke a limit switch both reverses the motor and increases its speed in this way effecting a rapid return stroke.



An electric heat-treatment furnace under construction is of the vertical cylindrical type

Heat Treatment of Castings

After the casting has passed inspection it is conveyed to a heat-treatment furnace. This is 88 ft. long and has three zones—pre-heating, soaking and cooling. There is a door at each end of the furnace, *i.e.*, inlet and outlet, and one between each two adjacent zones. They are driven individually by separate motors *via* gear boxes and winding drums. Each motor has forward and reverse contactors, but all the contactors and hence all the doors are operated by one push-button. On each door there is also a limit switch which stops the motor when the door is fully opened, while another limit switch puts in circuit a pilot lamp at the push-button station. When all four pilot lamps are " on " the furnace pusher gear is operated. This pusher gear is driven by a 10-HP motor which serves, through reduction gear, a screwed rod on which a nut travels with the rotation of the rod. To the nut is attached the two pusher arms. This motor does not automatically reverse, but requires the operation of a reverse push-button to bring the pusher rod back to the starting point. The " in " and " out " limits merely stop the motor at the end of each stroke.

At the exit end of the furnace the bogies run out on to a short section of rail (one at a time) which is carried on another rail system in a pit at right angles to the furnace line. By this means the bogie is drawn aside from the furnace for unloading. A limit switch in the pit makes circuit when the rail section is in line with the furnace, and only in this position is the push-button controlling the pusher gear operative. Rapid recirculation of the hot air in the furnace is provided for by two 25-HP motor-driven blowers, mounted on the roof of the furnace.

A new electric furnace now under construction is of the top-loading vertical cylindrical type. Zig-zag ribbon resistors are hook-suspended on the refractory furnace lining and they are supplied at 400 V 3-phase and are balanced on delta connection. The furnace elements are arranged in two zones. The lower of these zones is loaded at 100 kW and is controlled by one pyrometer which regulates the temperature by operating a contactor which switches in or out the whole element bank. The time ratio between elements " on " to elements " off " determines the temperature of the zone, and is governed by the pyrometer setting. The upper zone is loaded at 50 kW and is similarly controlled by the second pyrometer. The third or " policeman " pyrometer operates if either of the other two pyrometers fails. The lid is self-operated. On pushing a button it rises automatically and runs sideways on to a platform, the movement being governed by limit switches, one of which breaks the element circuit as soon as the lid rises.

Linear Power Scales

Diagrams for Series Impedance Circuits

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THE series impedance circuit of fig. 1 (*a*) is typical of a short transmission line, a synchronous motor in which the effective impedance may be assumed constant, or a transformer in which the magnetising admittance is excluded. The corresponding vector diagram is given in fig. 1 (*b*). In conformity with usual practice, either a single-phase system or one phase of a balanced polyphase system is premised.

Various geometrical constructions have been devised to represent the performance of such a circuit when certain direct or indirect restrictions are placed upon some of the variables. Each such diagram possesses special advantages, and is often capable of application to more than one type of problem.

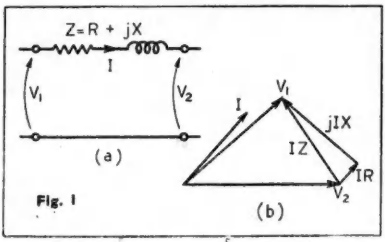


Fig. 1

There is, however, a tendency to identify a diagram with a particular piece of apparatus, which is in some ways rather a pity; a more general name might call attention to its other uses. For instance, the voltage diagram developed by Blondel in connection with synchronous machines may equally well be (and is) drawn as a current diagram, and as such applied to transmission lines as well as machines.

Known constructions generally embody voltage or current loci; useful, and less frequently reactive, power are often derived, but the scales for these are not always uniform or linear. The two complementary diagrams to be described, which are of the current locus type, have the particular advantage that the same linear scale obtains for all watts and vars. One of these diagrams is based on a constant magnitude for V_2, the other on a constant magnitude for I; V_1 is constant in magnitude and phase in both. Current may flow in either direction, giving thus both motor and generator conditions. Numerical values are adopted to clarify the application.

In fig. 2, it is supposed that V_1 is 200 V, V_2 is 240 V, R is 25 ohms, and X is 97 ohms, making Z equal to 100 ohms. Axes OA, OL, respectively in phase and quadrature with V_1, determine corresponding components of I and hence motoring input watts and vars. A circular arc COBD is drawn passing through O, with centre A in OA and radius $AO = \frac{V_1}{2R} = 4$ A. The chord $OB = \frac{V_1}{Z} = 2$ A gives the short-circuit current I_s, in magnitude and phase. A second circle CQDS is drawn with

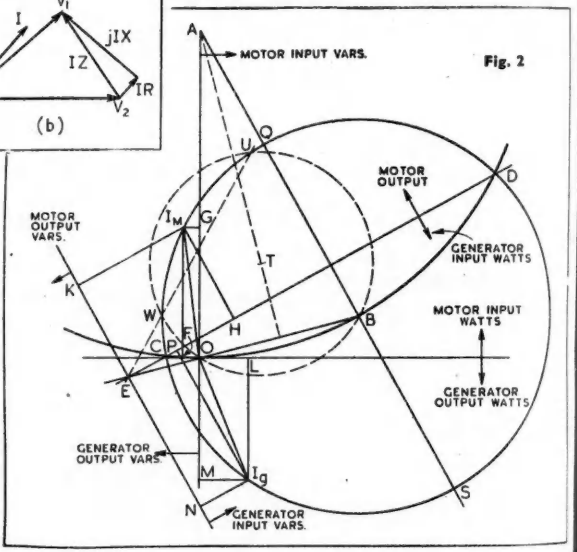
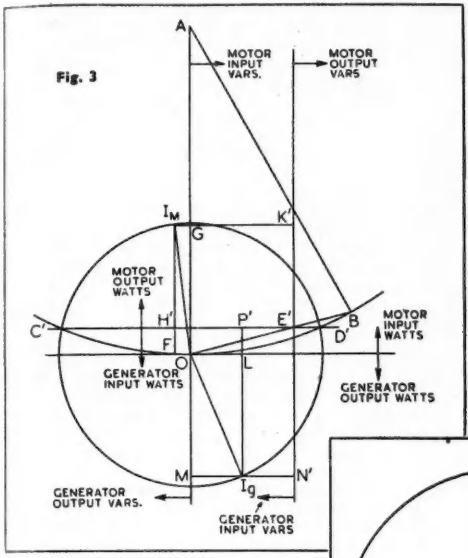


Fig. 2

centre B and radius $\frac{V_2}{V_1} \times OB = 2{\cdot}4$ A. AB is joined and produced, cutting this circle in Q and S. So far, the construction resembles that of the Blondel diagram. Now DC, the

radical axis of the two circles, is drawn and produced to cut BO produced in E, and KEN drawn normal to DE. It may easily be shown that E is the origin of motoring output watts and vars, and EK, ED their axes, for the stipulated values of V_1 and V_2, the locus of the state point (end of current vector) being the arc CQD.



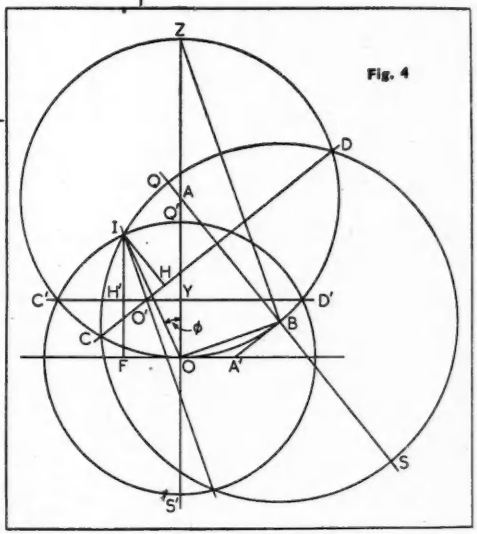
Consider, for instance, a motoring current $OI_m = 1{\cdot}6$ A. The input is $V_1.I_mF = 317$ W, $V_1.(-I_mG) = -41$ vars; the output is $V_1.I_mH = 253$ W, $V_1.(-I_mK) = -289$ vars. It will be noted that the same scale (current scale $\times$ V_1) applies in each case. The result is evidently correct, since $317-253 = 64$ W loss, $(-41)-(-289) = 248$ vars loss, which corresponds to $(1{\cdot}6)^2 \times 25$ W and $(1{\cdot}6)^2 \times 97$ vars absorbed in the impedance.

Generator conditions are obtained when the state point is on the lower arc CSD. Consider a current $I_g = 1{\cdot}6$ A, the same numerical value as before. The input is $V_1.I_gP = 361$ W, $V_1.I_gN = 130$ vars; the output is $V_1.I_gL = 297$ W, $V_1.(-I_gM) = -118$ vars. Checking, the losses are $361 - 297 = 64$ W, $130 - (-118) = 248$ vars, as shown in the preceding paragraph.

It will be apparent that the location of E is particular to the value of V_2. As this changes, E moves along EOB, and it may be shown that $\frac{BE}{BO} = \frac{V_2^2}{V_1^2}$. (Another simple construction, shown by broken lines in fig. 2, for locating E is to draw a constant output power factor locus, which is a circle passing through O and B and having its centre at T on the median AT of the triangle OAB. The radical axis UW of this circle and the circle CQDS must pass through E.)

The complementary diagram is shown in fig. 3, in which the nomenclature of fig. 2 is preserved as far as possible. The figure is drawn for the same values of V_1 and Z, and I is taken as 1·6 A constant. The output origin E' now divides OB in the ratio $\frac{OE'}{OB} = \frac{I^2}{I_s^2}$ and the output axes are parallel to OA and OL. The two state points for $V_2 = 240$ V are taken to correspond with the previous case, and it will be observed that the watts and vars are identical with those found on that occasion.

The validity of the construction is readily established. In fig. 4 three circles corresponding to those of figs. 2 and 3 are shown together. Considering motor power, and measuring lengths to the current scale, the input watts are $V_1 I\cos\phi = V_1.IF$. The copper losses are $I^2R = OI^2.R = OD'^2.R = OY.OZ.R = OY.V_1 = V_1.H'F$. Hence the output power is $V_1 I\cos\phi - I^2R = V_1(IF - H'F) = V_1.IH'$, in conformity with



the construction of fig. 3. Again, the radical axes of the three circles, by a well-known proposition, intersect at a single point O′. Since IO′ is normal to OB, and IH and IH′, being parallel respectively to AB and AO, are equally inclined to OB, the right-angled triangles IHO′, IH′O′ are equal in all respects, and IH = IH′. The value for output power is accordingly given by V_1.IH as required by fig. 2.

The construction for generator power is justified in the same way by taking the lower intersection of the circles. For vars, the circle COBD is replaced by another circle passing through O and B with its centre at A′ in the quadrature axis, its radius A′O being $\frac{V_1}{2X}$; the argument then proceeds exactly as that just given.

The basic equations governing the whole treatment are the simple relationships (output watts) + I^2R = (input watts): (output vars) + I^2X = (input vars). The first of these is very well known; the second is equally obvious, but is apt on occasion to be overlooked. The construction then serves to triangulate the three currents $\frac{V_1}{Z}$, $\frac{V_2}{Z}$ and I, since vectorially $V_1 = V_2 + I_mZ$, which on dividing both sides by Z becomes a current relation.

Maximum power points clearly exist at Q and S on the circle CQDS and at Q′ and S′ on the circle C′Q′D′S′. The absolute maximum motor power for the line when supplied at voltage V_1 obtains when Q and Q′ coincide at A; the current is then $OA = \frac{V_1}{2R}$, the input power factor unity, the output power factor $\frac{R}{Z}$ leading, the output voltage $V_2 = \frac{V_1Z}{2R}$ and the efficiency 50 per cent., since all three circles are the same size. All these results may be obtained algebraically, but the geometrical illustration is helpful and perhaps more convincing. (An absolute maximum var " output " similarly exists when the state point is at A′; the " input " power factor is then zero, the " output " voltage $\frac{V_1Z}{2X}$ and the " var efficiency " 50 per cent. Actually the point lies in the generating region and the useful power is consequently flowing the opposite way.)

Stability Limits

When the diagram refers to a synchronous machine, Q and S are the steady stability limits, for an excitation corresponding to an open circuit voltage V_2; the region to the left of QS is stable. It is, of course, inadmissible to approach either limit too closely in view of the liability of hunting into instability. With such a machine the appropriate value of Z depends on the saturation, and it is wise to take a rather smaller figure than that given by dividing the open circuit volts by the predicted short-circuit current for the same excitation.*

For transmission lines, stability will depend on the reaction of the load to changes; generally speaking, the presence of synchronous phase modifiers with quick-acting constant voltage regulators at both ends of the line section considered tends to maintain V_1 and V_2 constant, and the construction of fig. 2 gives the performance with QS as the stability limit.

A complete geometric construction is unsuitable for a normal power transformer, since the losses and voltage drops are relatively so small,† but for a leaky transformer such as is used to supply a " constant-current " type of load from a constant voltage source fig. 3 is a convenient representation. It is useful in such a case to add output power-factor loci, and to correct the input by the addition of no load watts and vars, which may be done by shifting the origin.

Should the inductance in the basic circuit be replaced by a condenser, the constructions are similar, but extend to the left instead of the right and vice versa. It should also be borne in mind that at a line point where a constant shunt admittance exists, the two line currents I_1 and I_2 on either side, and the voltage V across the admittance, may be correlated by an exactly similar process to that adopted for the series impedance-constant voltage arrangement, so that the same geometry may be used, with interchange of variables. As, however, a constant supply current is uncommon, this adaptation is not normally required in power work.

* See also "Alternating Currents " by Dr. A. E. Clayton, p. 230, et seq

† Partial approximate constructions, in which one origin is so remote that its rays may be assumed to be parallel, are effective.

Life-Jacket Light

A LIFE-JACKET light for seamen, made by Easco Electrical Service, 6, Brighton Terrace, London, S.W.9, consists of two watertight parts, one of them containing a miniature lamp bulb protected by a transparent red dome of moulded material. It is attached to the shoulder of the life-jacket by a spring clip, which does not hamper movement, and is connected by a twin flexible cable to the battery accommodated in a pocket in the life-jacket. The light glows instantly upon the insertion of a captive plug into a socket on the top of the battery container, an obvious method that does not necessitate special instructions and enables the device to be tested at any time, while avoiding the need for a bayonet catch, switch, or lanyard, that may cause confusion. The battery is a single U.2 dry cell, which will provide light continuously for twelve hours. The lamp and shoulder clip portion measures 2¾ by 2¾ by 1½ inches and the battery container is 3¾ inches long by 1½ inches in diameter, together weighing 8½ ounces. All metal parts are brightly electro-plated.

Electricity Economy

Possible Savings in Industrial Works

TO what extent will the more economical consumption of electricity result in the saving of raw coal? Answers to that question were sought in an informal discussion in London before the Installations Section of the INSTITUTION OF ELECTRICAL ENGINEERS on February 11th.

The subject was introduced by Major R. H. Rawll (City of Birmingham Electric Supply Department). In the notes which he prepared for circulation before the meeting Major Rawll points out that in 1938 electricity supply undertakings in this country were consuming coal at the rate of approximately 15 million tons per annum, representing about 9 per cent. of the total national consumption of coal for all purposes. Raw coal can hardly be burned more economically in power stations than it is now. One of the functions of an electricity supply department is to ensure that generation takes place at maximum efficiency, the success achieved being clearly demonstrated by the reduction of the average consumption of coal per kWh produced between 1922 and 1939 from 2·75 to 1·4 lb., the decrease between 1932 and 1939 being 21 per cent. Therefore attention must be concentrated on avoiding wastage of energy sent out from power stations. Any steps in that direction must be taken without delay in a practical way, without incurring unnecessary expenditure on labour and materials.

There is little room for improvement in respect of avoidable losses in transmission and distribution systems. For instance, the periodic switching out of service of surplus transformer capacity is not easy when loads fluctuate as they do just now. But a more careful watch on the amount of conversion plant in use in relation to the demand for DC can be fruitful of results. The operation of voltage boosters on long DC feeders should definitely be restricted to such periods as circumstances render imperative.

Reduced Standards of Comfort

The usual scrutiny of their quarterly accounts normally keeps most householders fully alive to the need for preventing deliberate waste of energy; rather should they be urged compulsorily to reduce the steadily rising accepted standards of comfort and convenience which increasing uses of electricity have fostered. National propaganda has laid too much stress on the necessity for reducing the amount of light provided in homes, resulting in the heavier current-consuming appliances being overlooked by their users. Curtailment of the use of radiators and water heaters will be most effective in saving energy; proportionate reduction in the use of cookers cannot be expected, since they are necessities rather than a convenient luxury.

In commercial and industrial premises, particularly the latter, definite cases of waste of energy are often of considerable magnitude. Also, in the aggregate, because of the variety of applications, there is far more scope for economy throughout industry than there can be in domestic spheres. Investigations must not only be systematic, but continuous check must be kept on economies instituted. The co-operation of employees is very necessary, since results will largely be determined by their individual reactions. The average worker cannot be blamed for the view that when flagrant waste of electricity is unchecked in factories it is foolish of him to continue to strive for economy in his own home, with its attendant sacrifices and inconveniences.

Wasted Motor Power

Experience of actual inspections recently made for the specific purpose prompts Major Rawll to point out the large proportion of motor power that is often wasted in line-shafting due to faulty alignment, bearings, or belting, which loss can be remedied by transferring load, or re-grouping machines. Motors are not infrequently left running light when no longer needed because the facility of control, even by push buttons when provided, is ignored. More effort should be made to avoid so much idle "shuttle" service by overhead cranes used for transporting materials.

It is uneconomical to run an entire rolling mill "train" when one "stand" only is to be used; when means of uncoupling exist they should be used. A modern development is the replacement of brass annular bearings and thrust rings by cotton fabric which has been impregnated with resinous compound under pressure.

The cost of conversion is not very great as existing chocks can usually be machined to accommodate the "plastic" bearings. All lubrication is by water sprays, eliminating the cost of oil and grease. In the actual case of a 9-inch bar and strip roughing mill, four stands three high, driven by a 350-HP motor which has been running with such plastic bearings for the last four months, the consumption of electricity has been reduced from 84 to 72 kWh per ton rolled, including the electricity used for water pumping, this corresponding to a saving of 15 per cent. Greater economy is possible with larger mills

owing to the heavier duty which is imposed upon the bearings.

The amount of electric light provided in industrial premises, especially due to black-out restrictions, merits careful attention ni respect of potential economy measures.

Investigation of the many furnace installations in use will generally reveal some means of saving power, while it is not always realised that the conversion of electricity to heat energy can be carried out with negligible loss, so that any waste that occurs is solely due to the method of utilisation. For example, it is wasteful to employ convected heat where there is rapid movement of air, while for the proper operation of thermal storage plant tables or charts of flow temperatures appropriate to different weather conditions are necessary. Similarly economy can be effected in domestic hot water systems by reducing the flow temperature to the minimum and by interrupting the circulation during the night.

In most areas at present the pronounced peak of demand is at 9 a.m. Anything that can be done to reduce load during periods of maximum demand, or transfer it to other times of the day, will reduce stand-by boiler losses and hence coal consumption. In this connection co-operation between users of large furnaces and suppliers of electricity will be beneficial; heaters might be switched half-on in business premises half an hour earlier than usual and then off before the staff arrives, their subsequent use being forbidden until later in the morning. Likewise domestic consumers might refrain from using hand-controlled heaters of any kind during the morning.

Fair Trading

Council's Report for the Past Year

IN its report for 1941-42 the Electrical Fair Trading Council says that during the year the membership has been considerably strengthened by the direct representation of the B.E.A.M.A. Accessories Section, the B.E.A.M.A. Heating, Cooking and Domestic Appliance Section; the British Synchronous Clock Conference; the Domestic Electric Refrigeration Association (D.E.R.A.); and the Electric Water Heater Manufacturers' Association.

Several editorial adjustments have been made to the schedules of the Fair Trading Policy as the result of experience gained since the introduction of the current issue in July, 1939. Schedule 3 (Industrial and Commercial Types of Electric Light Fittings) has been entirely recast to give more explicit definition of the fittings covered. The basis discounts, at present specified for urns (small and large) under Schedule 5 are under reconsideration, with a view to all sizes being placed within one discount category.

In Schedule 7 the whole of Category (b), "Batteries and Battery Materials," will in future be classified for a basis trade discount of 33⅓ per cent. (25 per cent. recognised users' discount), the remainder of this Schedule, *viz.*, "Apparatus," standing at 25 per cent. basis trade discount (15 per cent. recognised users' discount).

All agreed modifications will appear in Edition 3 of the Policy when reprinting is decided upon. It will also include a further Schedule 10 for synchronous electric clocks. The Council has also decided to include under Appendix A to the General Principles the following clause:—"Purchase tax when applicable shall be charged in full to the buyer as an addition to the list price and settlement of such tax shall be made without any deduction whatsoever."

Having regard to the shortage of many electrical products and in the interests of fair trading the Council published a general recommendation to the industry last March, that manufacturers and wholesalers alike should give first preference in the distribution of available supplies to those contractors and retailers who were known to have been fully established in the electrical industry before the war. Most manufacturers and wholesalers have adopted a system of rationing in accordance with this recommendation.

In view of the recent increase in the amount of domestic electrical apparatus of inferior design or workmanship offered for sale to the general public, the Council deemed it desirable to advise all members of the trade that in their own interests they should discourage the resale and use of any electrical apparatus which was dangerous or inefficient in design.

The report mentions the ruling made last March, in collaboration with the Central Price Regulation Committee, and reported in the electrical Press, regarding price-controlled goods and manufacturers' list price advances.

The following is a list of Associations which are members of the Council, the names of their representatives being given in parentheses:—

The Accumulator Makers' Association (Messrs. E. S. New and F. C. Vine); British Electrical & Allied Manufacturers' Association (Messrs. T. W. Heather, C. Rodgers and V. Watlington); B.E.A.M.A. Accessories Section (Messrs. F. G. Allen, A. E. Mills and E. D. Ruddle); B.E.A.M.A. Heating, Cooking and Domestic Appliances Section (Messrs. E. G. Batt, G. J. Berry and J. A. Fraser); British Synchronous Clock Conference (Messrs. D. W. Barrett, H. M. Harris and A. Middleton); The Cable Makers' Association (Col. Sir Thomas F. Purves, Mr. H. D. Roberts and Mr. A. E. Tanner); Domestic Electric Refrigeration Association (Messrs. E. G. Batt, W. Brett Daniels and A. E. Lever); Electric Lamp Manufacturers' Association (Messrs. J. Y. Fletcher, N. V. Everton and W. J. Jones); Electric Light Fittings Association (Messrs. A. J. Burbidge, A. E. Iliffe and K. Scott Adie); Electric Water Heater Manufacturers' Association (Messrs. E. G. Batt, G. J. Berry and D. G. Rodger); Electrical Wholesalers' Federation (Messrs. A. Albrecht, A. G. Beaver and A. B. Wildsmith); Electrical Contractors' Association of Scotland (Messrs. J. Allan, W. Finlay and D. H. Morris); National Electrical Contractors' Trading Association (Messrs. T. E. Alger, L. C. Penwill and W. H. Walton).

Mr. W. Finlay is chairman, Mr. V. Watlington vice-chairman and Mr. Felix A. Rogers secretary.

Red Cross Appeal

First Lists of Covenants and Donations

IT is less than three weeks since the appeal by the late Lord Hirst for support of the Electrical Industries Red Cross Fund was sent out. The response has been very satisfactory so far and as will be seen from the first lists of deeds of covenant and donations printed below, all branches of the electrical and radio industries are represented. We hope in later issues to publish further long lists.

Covenanted Subscriptions (gross)

	£	s.	d.
General Electric Co., Ltd.	2,000	0	0
Murphy Radio, Ltd.	210	0	0
Decca Radio & Television, Ltd.	200	0	0
Aish & Co., Bournemouth	105	0	0
Electrical Times	100	0	0
Wireless & Electrical Trader	100	0	0
Electrical Review	100	0	0
Wireless World and *Wireless Engineer*	100	0	0
Sterling Varnish Co., Manchester	100	0	0
Berry's Electric, Ltd.	50	0	0
Southern Areas Electric Corp., Ltd.	50	0	0
Dussek Bitumen & Taroleum, Ltd.	50	0	0
Everett Edgcumbe & Co., Ltd.	21	0	0
Charles F. Pardoe, Hull	20	0	0
A. P. Lundberg & Sons, Ltd.	20	0	0
W. H. Tew & Co., Nottingham	20	0	0
British Tungsram Radio Works	20	0	0
Philip Gaya, Ltd., Glasgow	10	10	0
T. W. Broadbent, Ltd.	10	0	0
Lilleker Bros., Rotherham	10	0	0
Young (Glasgow), Ltd.	10	0	0
Andrew Chalmers & Mitchell, Glasgow	10	0	0
Electricity Department, Salford	10	0	0
W. Finlay, Edinburgh	10	0	0
A. J. Holt & Co., Ltd., Harlesden	10	0	0
Mycalex Parent Co., Ltd.	10	0	0
H. J. Sanders & Son, Minehead	10	0	0
Batterby & Hefford, Ltd., Derby	6	6	0
James W. Thornes, Dewsbury	5	0	0
John Richards & Co., Burton-on-Trent	5	0	0
H. G. Weaver, Bristol	5	0	0
Lawrence & Nicholas, Ltd.	4	4	0
Arthur J. Newman, Bristol	4	4	0
R. E. & C. Marshall, Ltd., Cheltenham	4	4	0
Haydn Burns, Broseley, Salop	2	10	0
Bernard C. Ward	2	2	0
Bideford Radio Services	2	2	0
H. T. Burden, Maidstone	2	2	0
D. Heaton, Wigan	2	0	0
Total	£3,468	7	0

Donations

	£	s.	d.
North Eastern Electric Supply Co.	1,000	0	0
Chloride Electrical Storage Co.	250	0	0
Cryselco, Ltd.	101	10	0
Falk, Stadelmann & Co., Ltd.	100	0	0
Borough Treasurer, Brighton	100	0	0
Telegraph Construction & Maintenance Co., Ltd.	50	0	0
Telegraph Condenser Co., Ltd.	25	0	0
Wingrove & Rogers, Ltd.	25	0	0
B.E.A.M.A.	25	0	0
Electrician	25	0	0
Heenan & Froude, Ltd.	21	0	0
Ferguson, Pailin, Ltd.	15	15	0
H. E. Williams & Co., Colchester	10	10	0
Diamond " H " Switches	10	10	0
Drake & Gorham Wholesale, Ltd.	10	10	0
R. H. Symonds, Ltd., S.W.1	10	10	0
R. S. Caplin, Ltd., London, W.1.	10	10	0
Drake & Gorham, Ltd.	10	10	0
Falkirk Iron Co., Ltd.	10	0	0
Mitchell Engineering, Ltd.	10	0	0
Johnson, Burton & Theobald, Norwich	10	0	0
H. J. Goulding & Co., Ltd.	5	5	0
Whitworth Electric Lamp Co., Ltd.	5	5	0
S. H. Heywood & Co., Ltd.	5	5	0
Oliver Melville & Co.	5	5	0
Marryat & Place, Ltd.	5	5	0
Reeves & Co., Birmingham	5	5	0
Gray Bros., Ltd., Newcastle	5	5	0
Eli Mercer, Castleford	5	5	0
Radio & Elec. Equip. Renters, London, N.12.	5	5	0
Macrome, Ltd.	5	5	0
Shimwell, Alexander & Co., Southampton	5	0	0
Midland Dynamo Co., Ltd.	5	0	0
Brown McLachlan & Polson, Glasgow	5	0	0
Lincoln Electric Co., Ltd.	5	0	0
" Dorset House "	2	17	0
J. H. Watts, Somerton	2	10	0
John Steel, Bingley	2	2	0
Williams & Back, Ltd., W.1	2	2	0
Farnham Gas & Electricity Co.	2	2	0
Scottish Radio Retailers' Association	2	2	0
British Electric & Mfg. Co., Ltd., Newcastle	2	2	0
Wholesale Fittings Co., Ltd.	2	2	0
London Electric Firm, Croydon	2	2	0
James Robertson, Glasgow	2	2	0
Don Battery Service, Doncaster	2	0	0
Brown McLachlan & Polson	2	0	0
S. R. Hare & Son, Birmingham	1	1	0
G. C. Large, Cardiff	1	1	0
James & Co., Ltd. (Radio), Raynes Park	1	1	0
Tucker Electrical Co., Ltd., Cardiff	1	1	0
J. G. Sneath, Ltd., London, E.14	1	1	0
Stearn Electric Co., Ltd.	1	1	0
Agro Electrical Co., Ltd.	1	1	0
Honor Bros., London, W.5	1	1	0
J. S. Farr, Ltd., Nottingham	1	1	0
D. E. Hall, Glasgow	1	1	0
R. H. Frost, Gateshead	1	1	0
Stenson & Co., Dundee	1	0	0
Gilbert & Stamper, Tonbridge	1	0	0
Tom Jones, Ltd., Liverpool		10	6
Elect. & Gen. Accessories, Ltd.		10	0
Total	£1,939	8	6

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CORRESPONDENCE

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for correspondents' opinions.

Fuses and O.C.B.'s

THE backing up of medium-voltage circuit-breakers when their capacities have been outgrown by short-circuit conditions is correct, as Mr. G. Cluley mentions in his article in your issue of January 29th, so long as the electro-dynamic stresses on the circuit-breaker corresponding to the value of the output characteristic of the fuses are no greater than may be safely applied to the breaker. Because the cut-off value of the fuses is a function of current rating, there is a limit to the current rating of circuit-breakers which may be backed up by high-rupturing-capacity fuses. The only satisfactory remedy then is the installation of a new circuit-breaker. There are, however, other points to be considered.

Circuit-breakers having a maximum rupturing capacity of 25 MVA at 400 V are at present manufactured, but the electrical plant they control, either directly or indirectly, is not built to withstand either the thermal or electro-dynamic effects of, for example, a 25-MVA fault on windings near its terminals.

The installation of a new circuit-breaker where the fault current has grown unduly is correct, provided it controls busbars which supply individual circuits through h.r.c. fuses for cutting off or limiting the current which may be fed into the apparatus. With this arrangement non-discriminating but sensitive earth-fault protection can be obtained irrespective of the rating of the fuses.

A medium-voltage circuit-breaker used for direct-starting a squirrel-cage motor may take five cycles to clear the fault, and the motor will be subjected to both the thermal and electro-dynamic effects of the system-peak short-circuit current that is fed into a fault in its windings. The peak value of the stresses on the motor can be reduced by means of h.r.c. fuses located between the oil circuit-breaker and the motor and as near as possible to the latter. The breaker deals with faults in the cabling up to the fuses and the fuses both clear faults and limit the fault current which may be fed to the motor. With this combination there is no necessity to limit the size of fuse in order to obtain earth-fault protection.

The reduction of fault current to a safe value should be tackled at the root, namely, the step-down transformers. Thus, in the case of existing large transformers, reduction of lower-voltage short-circuit current may, for example, be accomplished either by replacing cable between the lower-voltage terminals and the circuit-breaker or isolator by widely spaced bare-copper connections or by the use of external reactors. The additional safety in operation and in plant protection obtained would far outweigh the adverse effect on voltage regulation. The foregoing, together with the minimising of the number of inter-connected points in the network, would therefore be the first modifications.

It appears to me that it is not a case of fuses *versus* oil circuit-breakers, but the giving of careful consideration to the degree of combination of the two desirable with the use of automatic h.r.c. switch-fuses with current-transformer-operated earth-leakage trips at points where the use of oil circuit-breakers is not justifiable economically. Finally, and of the utmost importance, is the limitation of the size of step-down transformers and correct network design.

A. BERMAN, Grad.I.E.E.
Northwick, Ches.

The Central Register

THE letter from " Over Fifty " published in the *Electrical Review* of February 5th appears to indicate that the writer is slightly disgruntled (*a*) with the Government Department which employed him and (*b*) with the Central Register. In the case of (*a*) it is agreed that this Government Department has been advertising since the start of the war; some of its early advertisements offered salaries of £350 or £375 per annum, but the figure has increased and has now reached £550 per annum, with a further inducement of a board and lodging allowance of £2 5s. per week. This advertisement appeared in the *Electrical Review* dated January 22nd under the Central Register's reference " D315 " and I am told on authority that there are a number of vacancies to be filled.

This Department's requirements are very exacting; it certainly requires a lot for the wonderful salaries which it pays. On one occasion eight or ten assistant mechanical and electrical engineers resigned *en bloc* and at the present time there is considerable discontent among many others largely due to the inadequate salaries. The existence of this condition has a bad effect on the progress of the work and this no doubt reacts badly against the requirements of a very important branch of the fighting Services which in my view should have the very best technicians that can be provided, with commensurate salaries.

When the war started this Department thought that at the crack of the whip all the electrical profession would be begging for

jobs; on the contrary it has had considerable difficulty in finding suitable persons to meet its exacting requirements. The Central Register knows this and it is borne out by the number of advertisements that have appeared in the daily and technical journals. The advertisements have not accurately set out the duties attaching to the post of assistant mechanical and electrical engineer.

The Central Register should use its powers of direction but at the same time should insist on just salaries commensurate with the qualifications required.

"Over Fifty's" other complaint is easily met. To be restored to the Register all that is necessary is a letter to the Secretary, Minister of Labour, stating that employment is required. This should produce results. Giving credit where it is due, in under ten days I received notification of four vacant posts, not that they fitted into my particular experience, but it was certainly an effort to fix me up with a job.

CHARTERED ELECTRICAL ENGINEER.
Harrow.

Checking Calculations

IN your issue of January 29th, 1943, Mr. A. E. Norris shows a method of checking the correctness of calculations. Perhaps the following old method of taking "nines" out will be of interest.

Taking Mr. Norris' example of 973,582 × 85,631 = 83,368,800,242; to check, add the numerals, and divide by 9; ignore quotients and consider only remainders.

Then, 973,582 = 34 ÷ 9 = 3 + 7
85,631 = 23 ÷ 9 = 2 + 5
83,368,800,242 = 44 ÷ 9 = 4 + 8

To check—7 × 5 = 35 ÷ 9 = 3 + 8.

For addition adopt the same method, but add remainders:—

973,582 = 34 ÷ 9 = 3 + 7 } = 12 ÷ 9 =
Plus 85,631 = 23 ÷ 9 = 2 + 5 } 1 + 3
1,059,213 = 21 ÷ 9 = 2 + 3

For subtraction deduct remainders:—

973,582 = 34 ÷ 9 = 3 + 7 } = 2
Minus 85,631 = 23 ÷ 9 = 2 + 5 }
887,951 = 38 ÷ 9 = 4 + 2

Sanderstead, Surrey. J. W. PORTER.

[This method is also set out in a letter from Mr. A. Paterson, Ashington, Northumberland.—*Eds., Electrical Review.*]

MR. A. E. Norris is not quite accurate in his statement that his method of checking proves that a calculation is correct; it can only prove that an answer is incorrect. The product 83,368,800,242 is not the only number that, when added up in the manner described, will finally come to 8. Examples of other answers that would give a final digit of 8 are 24,200,886,338, 698,147, 2,222, and even 8 itself.

It is true that if the final digits obtained do not correspond the answer is incorrect, so the method has certain applications. If, for example, an answer is believed to be incorrect, the method will probably prove it. Incidentally, the chances of its doing so are eight to one.

Bath. F. T. BENNELL.

THE arithmetical conjuring trick given by Mr. Norris is very ingenious, and it is quite true that if the multiplication is correct the last two digits will be equal. The converse, however, is not true, and the method is not a proof. For example, if we say:—

13 × 13 = 196 (*sic*)
4 × 4 = 16
16 = 16
7 = 7

but the multiplication is not correct.

Hull. IAN D. CAMPBELL.

Fuel Economy and Water Power

MAY I submit to your readers two statements and leave each to form his own conclusion? You report, in your issue of January 29th (p. 157) a statement by Mr. James Rankin (North Wales Power Co.) that "every unit used unnecessarily in North Wales meant that another unit had to be generated at a steam station."

Last March I wrote to every producer of electricity from water power in Great Britain as follows:—

> "We want to submit to the Committee about to sit on 'rationing electricity' practical information concerning cases where reducing the amount of electricity cannot prove an economy. Take a simple example:—A member of our Association (in North Wales) has available, with no increase of existing plant, sufficient electricity from water power to supply his present consumers and to supply a further one hundred premises in his village, which latter now use coal for heat and oil for light. If his available electricity were thus utilised, the net result would be a considerable saving of coal and of transport by petrol-driven lorries over many miles of road."

Herne Bay, Kent. J. E. GREEN, *Chairman*, Association of Non-Statutory Electricity Suppliers and Distributors.

An Engineers' Centre

REFERRING to the letters of your correspondents Mr. J. B. Harris and Mr. Dennis Johnson in your issues of December 25th and January 8th, in connection with the proposal to form an Engineers' Centre, I and some colleagues have been

considering for some time past, the formation of an Engineers' Club which might well form the nucleus of the more ambitious scheme proposed by your correspondents.

The suggested Club would be on more social lines than the present rather formal meetings of the professional institutions and in addition to normal club facilities, would probably include some form of lecture room where informal discussions could take place on subjects of general interest to engineers. It is proposed to arrange for boarding facilities so that engineers from the Provinces could be accommodated.

In addition to giving the possibility of informal discussions on technical points and business generally, we think that such a club would enable the engineering profession to focus their attention on the subject of post-war reconstruction, in which, of course, they will probably have the largest say of any section of the community.

I shall be glad to hear the views of your readers, particularly those who would be willing to participate in such a project.

New Barnet, Herts. W. O. JACKSON.

Steam Boiler Control

I HAVE only just read your issue of January 29th, and regret that the statement reported on page 158, of what I said at the I.E.E. meeting on January 22nd, is not quite correct. The sentence " that later on it could be extended to full electrical operation " should read *automatic* instead of *electrical*.

The paragraph about CO_2 control is also incorrect. I cannot remember the exact words I used but I definitely did not say " why had that disappeared." I believe I said "Why had that been left out of the paper." The next sentence is also incorrect. I did not use the words " sufficiently accurate " but asked if in the authors' opinion CO_2 recorders were not sufficiently *reliable* to embody them in an automatic control system.

Stanmore, Middlesex. J. E. O'BREEN.
(James Gordon & Co., Ltd.)

Insulated Cleat Wire

New Emergency Specification

IN the War Emergency Specification for wiring on cleats (B.S. 1063, 1942), one of a series dealing with electrical installations, it is prescribed that the wires shall be either rubber-insulated or protected bare wire. When drafting the specification, however, it was appreciated that there were difficulties in either of these applications; for instance, rubber would probably not be available for this type of use, and the use of bare wire involves the danger of shock or, alternatively, the provision of external protection.

To meet this position a type of cable has been evolved for erection on insulating cleats inside buildings, the covering being intended to provide a degree of mechanical protection and also to ensure reasonable protection from shock under all normal conditions of atmospheric humidity inside buildings. The essential features of this wire are given in a new War Emergency Specification B.S. 1096 (insulated cleat wire). To make provision for the use of this type of wire, B.S. 1063 is being amended. Copies of B.S. 1096 may be obtained from the British Standards Institution, 28, Victoria Street, London, S.W.1, price 6d., post free.

American Lamp Restrictions

Number of Types Halved

NEARLY two thousand types of electric lamps hitherto made in the United States will be available no longer under the terms of the Order made by the War Production Board to which reference was made in a recent issue. The cut has been made in order to conserve materials and production capacity. Nevertheless, about 1,700 types will remain and the Board expects that adequate supplies of the permitted types will be produced to compensate for those which will no longer be made.

In deciding which lamps to eliminate the Board was guided by a number of considerations. Primarily lamps for which there are suitable substitutes and those for which there is no essential demand are discontinued. Lamps which had been made in a great variety of different voltages and wattages are now simplified so that only a fraction of the previously made types will be required. Only three colours will now be available instead of the large number of colour variations used previously.

A schedule of permitted types is appended to the Order. The only exceptions are lamps designed for diagnostic and surgical purposes and those produced for the Army, Navy, Maritime Commission, War Shipping Administration and Lend-Lease purposes. Even lamps for military uses cannot be made if there are suitable substitutes in the schedule. The Order also imposes restrictions upon the manufacture of lamp parts.

In the case of fluorescent lamps, phosphor coatings containing beryllium or cadmium cannot be produced without specific authorisation of the Director-General for Operations. Beryllium and cadmium are essential to the war effort and if authorisation is given for their consumption they must be used in accordance with the instructions of the War Production Board.

Restrictions are also placed upon the etching of bulbs except by manufacturers who put their own or another manufacturer's identification marks on the bulbs or by those who will use the bulbs for their own purposes. The order prohibits the production of glow discharge lamps for non-essential purposes.

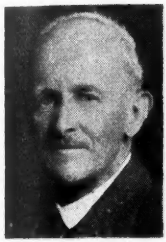
It is estimated that the restrictions will result in the saving of 7 per cent. of the materials formerly consumed, including 650 tons of steel, 35,000 lb. of solder and 8,000 lb. of tungsten. About 1,300,000 man-hours of direct labour will be released for the production of radio valves and other war products. Moreover, about 325,000 sq. ft. of manufacturing floor space and 400,000 sq. ft. of warehouse space will be made available.

PERSONAL and SOCIAL

News of Men and Women of the Industry

THE Council of the Institution of Electrical Engineers has elected **Lord Hankey** an Honorary Member of the Institution, and has made the twenty-first award of the Faraday Medal to **Sir Archibald Page.**

Making the announcement at last week's meeting of the Institution the President, Prof. C. L. Fortescue, said that the distinction had been conferred upon Lord Hankey in appreciation of the services he had rendered as Secretary to the Cabinet and Clerk to the Privy Council, as chairman of Scientific and Engineering Advisory Committees to the War Cabinet, and



Lord Hankey

Sir Archibald Page

chairman of the Technical Personnel Committee, which was established largely on the suggestion of the Council of the Institution. In the last-named capacity Lord Hankey carried into effect many of the recommendations put forward by the Institution, notably in connection with the intensified training of engineers for the war effort, and the Engineering Cadet Scheme.

The award of the Faraday Medal to Sir Archibald Page, Honorary Member and Past President of the Institution, was made in recognition of his outstanding services during a long and distinguished career in the sphere of electricity supply, and particularly for the leading part he had taken in the planning, construction and operation of the national grid system, which had been so successfully established and had proved of inestimable value in the prosecution of the war. Sir Archibald was deputy city electrical engineer at Glasgow from 1905 to 1917, general manager of the Clyde Valley Electric Power Co. from 1917 to 1920, and an Electricity Commissioner from 1920 to 1925. He was director and general manager of the County of London Electric Supply Co. from 1925 to 1927, and became general manager of the Central Electricity Board in 1927. Since 1935 he has been chairman of the Board.

Following the retirement, on December 31st, 1942, of **Mr. W. E. Brandreth,** A.M.I.E.E., from the position of general manager of the Wessex Electricity Co., he was recently presented with a canteen of cutlery and a filing cabinet, together with an autographed album containing the names of the subscribers. Mr. Brandreth had been general manager of the Wessex Co. since 1929 and has seen the company grow from an undertaking supplying electricity to only 400 consumers up to its present extensive proportions with 133,798 consumers in 1,149 towns and villages.

The presentation was made by Mr. W. D. Fisher, A.M.I.E.E., chief engineer of the company, who expressed regret on behalf of the directors and staff that Mr. Brandreth was retiring from the company. Mr. A. E. Jones, engineer and manager at Lymington and one of the oldest members of the staff, seconded the remarks of Mr. Fisher.

Mr. Brandreth has been succeeded by **Mr. H. B. Style,** formerly commercial manager to the Shropshire, Worcestershire and Staffordshire Electric Power Co.

Mr. R. A. Ure, J.P., A.M.I.E.E., is the president of the Electrical Contractors' Association of Scotland for 1942-43. Mr. Ure was also president for 1924-26 and has been a partner in the firm of Allan Arthur & Ure since its inception in 1902.

Mr. R. H. Addlesee has been appointed deputy general manager of the Wolverhampton Corporation Transport Department, and **Mr. F. B. Reid** has been appointed traffic superintendent.

Viscount Falmouth, M.I.Mech.E., Comp. I.E.E., has consented to remain president of the British Electrical and Allied Industries Research Association for a further year.

Mr. T. H. Carr, whose suggestions for the formation and lines of action of an I.E.E. Generation Section are published on page 204, has been deputy electrical engineer and manager of the Bradford Corporation Electricity Department since 1941. He went to Bradford from Derby where he was power station superintendent. Mr. Carr is the author of the book "Electric Power Stations," published in 1941, and it is indicative of the interest shown in this subject that the first edition was sold out just over a year after its publication.

Mr. T. H. Carr

On January 20th the Manchester Corporation Electricity Committee made a presentation to **Mr. J. A. Handley** on his retirement from the position of chief accounts clerk after a period of forty-eight years' service, a record for the undertaking. Mr. Handley joined Mr. C. H. Wordingham and Mr. W. McClelland at Dickinson Street generating station in May, 1894, within ten months of the commencement of Manchester's electricity supply in July, 1893. At that time he evinced a keen interest in the technical side of the work, spending many early morning and late evening hours in the engine room, and recalls the operation of the Hornsby

100-HP generating sets and the Gwynne centrifugal high-speed condensing water pumps. Later, when the undertaking expanded, he went over to the Town Hall, turning his whole attention to the commercial, statistical and accountancy side, and for many years held the position of chief wages clerk, until in 1926 he became chief accounts clerk.

News has been received that **Mr. L. C. F. Bellamy,** general manager of Hong Kong Tramways, Ltd., is in a civilian internment camp in the city. His friends will be pleased to learn that he is well.

Derby Town Council has decided to pay the borough electrical engineer, **Mr. F. H. Pooles,** a salary in accordance with the scale agreed by the National Joint Committee of Local Authorities and Chief Electrical Engineers by annual increments of £100, with effect as from July 9th, 1941.

In reporting the appointment of **Professor E. G. Cullwick,** of Alberta University, to organise a new electrical engineering branch of the Royal Canadian Navy (*Electrical Review*, January 22nd) his name was given incorrectly. Professor Cullwick was born at Wolverhampton in 1903 and was educated at the Grammar School there and at Cambridge. Afterwards he was with the British Thomson-Houston Co. and the Canadian General Electric Co. He was appointed assistant professor of electrical engineering in the University of British Columbia in 1928, and in 1934 and 1935 was lecturer in electrical engineering at the Military College of Science, Woolwich. He returned to the University of British Columbia, and in 1937 became Professor and Head of the Department of Electrical Engineering at the University of Alberta.

Obituary

Mr. G. E. Taylor.—In our last issue we briefly announced the death of Mr. George Edward Taylor, A.M.I.E.E., governing director of G. E. Taylor & Co. (London), Ltd., which occurred on January 26th at the age of seventy-six. Mr. Taylor commenced his career with the Electric Power Storage Co. at the time when the company was experimenting with traction batteries.

The late Mr. G. E. Taylor

One of the first experiments was with an old horse tram which was converted to electric drive using one of the company's batteries; to enable this to be done the height of the car was raised. A trial run was made in South London, and Mr. Taylor and another lad had to lie under the false floor wedging pieces of wood in the batteries to hold the plates together as these were rapidly disintegrating. Later he entered the service of Thomson & Ritchie and subsequently joined Laing, Wharton & Downe, Ltd., with whom he remained until the liquidation of that company. During this time he had full charge of the first electrical installation in the Blackwall Tunnel.

Mr. Taylor commenced business on his own account in 1899, and had carried out numerous large installation contracts both at home and abroad, including the second lighting installation in Blackwall Tunnel. He also had a share of the first Admiralty contracts for installations in the dockyards which were being handled by Preece & Cardew, consultants.

The late Mr. L. Davies

Mr. L. Davies.—The death occurred at Pontardulais on January 23rd, of Mr. Lewis Davies, lamp representative in the West and Mid-Wales Area of the Metropolitan - Vickers Electrical Co., Ltd. Mr. Davies, who was fifty-four, joined the Metropolitan-Vickers organisation in 1923.

Forthcoming Events

Institution of Electrical Engineers.—Monday, February 22nd, 5.30 p.m. Informal discussion on "Single- to Three-phase Conversion with special reference to the Ferraris-Arno System," to be opened by Mr. A. H. Maggs.

Wireless Section.—Tuesday, February 16th, 5.30 p.m. Informal discussion on "Electronics in Industry," to be opened by Messrs. E. Cattanes, G. T. Winch and A. L. Whiteley.

Measurements and Transmission Sections.—Friday, February 19th, 5.30 p.m. Joint meeting. Paper: "Busbar Protection—a Critical Review of Modern Methods and Practice," by Messrs. M. Kaufmann and W. Szwander.

North Midland Centre.—Saturday, February 13th, 2.30 p.m. Great Northern Hotel, Wellington Street, Leeds. Paper: "Coal for Steam Raising," by Mr. J. N. Waite. *Students' Section.*—Saturday, February 20th, 2.30 p.m. Griffin Hotel, Leeds. "Dialling over Long-Distance Telephone Circuits," by Mr. B. R. Horsfield.

Bristol Students' Section.—Friday, February 19th. Bath. Brains Trust.

North-Western Centre.—Saturday, February 20th, 2.30 p.m. Engineers' Club, Albert Square, Manchester. Joint meeting with the Institution of Post Office Electrical Engineers. Paper: "Fluorescent Lamps," by Messrs. L. J. Davies, H. R. Ruff and W. J. Scott. *Students' Section.*—Saturday, February13th, 2.30 p.m. Engineers' Club. Lecture by Dr. D. S. Anderson.

West Wales (Swansea) Sub-Centre.—Saturday, February 20th. Swansea. Paper: "Automatic Boiler Control."

Association of Supervising Electrical Engineers.—Saturday, February 13th, 2.15 p.m. Lighting Service Bureau, 2, Savoy Hill, London, W.C.2. Lecture on "Electrical Installation for Large Buildings," by Mr. J. Flood.

Association of Mining, Electrical and Mechanical Engineers.—Thursday, February 18th, Pontypridd. Visit of Chief Electrical Inspector of Mines.

Electricity Tariffs

Scientific Structure and Consumer Psychology

AT the meeting of the Institution of Electrical Engineers on February 4th, the President (Professor C. L. Fortescue) said that since the last meeting the Institution had suffered two unusual losses in the death of Dr. Alexander Russell and Lord Hirst of Witton. He paid a tribute to the valuable work of these two honorary members, and the meeting stood in silence for a few moments in their memory.

Messrs. C. T. Melling and P. Schiller then read their papers on electricity tariffs which were reviewed in our last issue. The ensuing discussion was opened by Mr. H. Hobson (Central Electricity Board) who remarked that in the framing of domestic tariffs, one of the most important things to be borne in mind, apart from costs and technique, was the psychology of the man in the street.

The authors had really asked two questions, *viz.*, was it possible, granted it was desirable, to adopt one common form of domestic tariff throughout the country, and, if it were, was it possible to adopt one common level of prices? He thought that one common form could be evolved and was demanded by the public, but he doubted whether one common price would readily be achievable without a drastic reorganisation of the industry. How far the reorganisation being considered by the Government would affect the tariff position we did not yet know. The time would come quite soon, however, when the industry must attend to this tariff matter.

Freedom from Restrictions

He deprecated any form of tariff which involved duplication of metering or wiring. What was wanted was a tariff which would not "break" the supply authority and at the same time would give the public what it wanted without unduly, or even at all, restricting freedom of choice or use except for economic reasons. He suggested that it would please the general public if artificial fixed-charge components were cut out altogether and, as in the United States, a block rate tariff employed. A block tariff could be constructed in such a way to do exactly what Mr. Schiller had pointed out as being necessary.

Mr. H. Nimmo said he would like to see Mr. Schiller's proposals put into effect. Undertakers should not require more than four tariffs, *viz.*, industrial, commercial, domestic and farm tariffs, although there might be justification in some places for a few special tariffs. Finally, he asked what useful purpose would be served by the examination of the various electrical, economic, industrial, sociological and competitive factors affecting undertakings and consumers suggested by Mr. Melling.

Mr. J. I. Bernard (E.D.A.) directed attention to the single block tariff, or "zone" block which had been used successfully for many years, particularly in Glasgow. Mr. Melling did not deal with it and Mr. Schiller condemned it because it was unsuitable for prepayment meters. In one part of London, however, a special form of prepayment meter was used to a considerable extent by which the money for the units at the high rate were credited from Friday night through the week-end and the low-priced units were charged for during the remainder of the week.

He doubted the wisdom of the contract demand system suggested by Mr. Schiller and preferred to continue to develop the domestic load as in the past, taking care that the unit rate was not reduced below cost. For water heating a higher rate should be charged in winter than in summer.

Uniform C.E.B. Tariffs

Mr. N. Elliott gave an analysis of the 554 undertakings in the country taking supply from the Central Board and said the prices paid varied from under 0·3d. to 1·5d. per kWh in 1938, and there were very different problems in formulating tariffs according to the prices paid. Many of the difficulties in regard to bulk supplies were caused by basic differences in methods of supply and not by differences in load factor and it was difficult to justify these differences when it was considered that the C.E.B., was the one authority generating all electricity fundamentally for the benefit of all consumers throughout the country and not for the benefit of the authorised supply undertakings. Therefore it seemed reasonable that authorised undertakers should receive their bulk supplies from the C.E.B., at one and the same tariff at an agreed point or points of supply.

The next step was to consider what form this national bulk supply tariff should take. He preferred a flat rate with a coal clause; in 1937–8 the charge on this basis would have been of the order of 0·385d. per kWh, which was the average revenue of the Board for that year.

Domestic tariffs should be as few and as simple as possible, and he would hesitate a long time before putting into operation a tariff such as that suggested by Mr. Schiller.

Mr. W. Fennell remarked that the electricity supply industry was the only one that had made any attempt to relate the price charged for the article to the exact cost of

getting it to each individual consumer and it was probable that many of the troubles of the industry were due to its having attempted the impossible. Although Mr. Melling advocated uniformity he had not given any hint as to the tariff he considered should should be adopted. On the other hand, Mr. Schiller, looking at the matter more theoretically had no doubt what should be done. Apparently an extra fixed charge should be made on every consumer who put in a cooker and it should be made impossible for anyone to use a radiator when it was cold !

Criticising methods involving rateable value or floor area, Mr. Fennell said his undertaking had gone along very nicely with a tariff based on lamps connected and everyone seemed satisfied. The tariffs for electric cookers and heaters were so arranged as to encourage the consumer to put in plenty of apparatus in order to get on to the lowest rate. It was wrong to have tariffs which caused any restriction of consumption and it was also wrong to increase the charge in any way, disguised or otherwise, as the quantity increased. Consideration should be given to abandoning all attempts to base fixed charges on the rateable value or size of the house.

Mr. D. J. Bolton thought the suggestion by Mr. Melling of biasing the grid tariff in the form of a higher fixed charge and a lower running charge was entirely retrograde ; it would intensify all the present discontent with regard to cold snaps and maximum demand anomalies because they would all be based on the higher figure. Moreover, it was entirely wrong from the cost point of view and he felt that a change of the C.E.B. tariff in the opposite direction to that urged by Mr. Melling would more likely be the most beneficial. Both sets of tariffs proposed by Mr. Melling were unnecessarily complicated and he regretted more was not said about industrial tariffs although there was more to be done in that connection than with domestic tariffs.

Simple Block Tariffs

What appeared to him to be needed was a block tariff comprising three blocks of fixed sizes up to 100 kWh consumption and then either a two-part or a variable block tariff for consumptions above that. Was it possible to find a simpler domestic tariff ? Even if it involved a higher price for some people, the charge would still be below the the value of the service given.

Mr. H. Bentham, speaking as a member of the 1925 and 1930 Tariff Committees, said that certain recommendations had been made and if they had been adopted by the Commissioners the present difficulties would not have existed. In his own undertakings there was a fixed charge for every kind of house and there had been no difficulty. It must be understood by the consumer that the size of the house had been adopted because of the serious discrepancies in rating methods. There must be only one meter. He was concerned that both authors seemed to condemn the heating load which should be developed.

Mr. F. B. Warder said that the Swedish Association of Electricity Works had produced a common rate book containing a common terminology. He briefly described the position and gave details of how certain tariffs worked, adding that the codification was very comprehensive and simple and seemed admirably suited to the conditions in this country.

Dr. L. E. C. Hughes objected to Mr. Schiller's proposed tariff on several grounds, one being that if another 60-W lamp was installed the consumer had to pay a further £1, and said he could not accept Mr. Fennell's complacency with regard to the lamps installed method because it was a direct inducement to people to be dishonest.

Mr. L. C. Gleaves considered that domestic tariffs were unduly complicated and suggested that the problem should be tackled from the other end by adjusting the charges made by the C.E.B.

Authors' Replies

Mr. Melling, in the course of a short reply, said that he did not condemn space heating, but the manner in which it was sometimes tackled. He believed that before many years electricity would capture the space heating load. In post-war houses there should be insistence upon suitable construction to satisfy space heating requirements.

He had not touched on grid tariffs because it was a subject bristling with controversy and was really a political feature nowadays. It was a matter better dealt with round the committee table than in public. He thought that the flat rate suggested by Mr. Elliott was entirely retrograde because it would not induce the development of off-peak load. There must be a low unit charge to consumers and there might be a three-part C.E.B. tariff ; in fact, this existed in many cases already. Mr. Fennell's lamp system involved too many inspections. He agreed that it was impossible to have unification unless they knew what they wanted.

Mr. Schiller, in his final comments, said the prepayment meter used for block tariffs at Hammersmith involved many difficulties and had not been proceeded with. With Mr. Melling, he said he had not deprecated space heating ; the whole problem was to sell it in a more remunerative way. The type of tariff mentioned as being used in Sweden was even more familiar in Norway. So much was charged for a certain demand for so many kW and all above that was charged at a certain rate per kWh.

COMMERCE and INDUSTRY

Mica Control. Hand Tool Restrictions.

Cable Supplies

FROM February 15th the procedure for obtaining bulk supplies of electric cables insulated with rubber and rubber substitutes is amended, and instructions have been issued to cable makers extending the field within which purchasers must obtain certificates of need. Details of the new procedure can be obtained by application to the cable makers, the Electrical Wholesalers' Federation, or to the Cable Planning Organisation of the Ministry of Supply.

Shipyard Electricians

The relaxation of working rules was discussed at a meeting last week between the Minister of Labour and National Service and representatives of electricians employed in the shipbuilding and repairing industry. Mr. Bevin and Mr. Hall, Financial Secretary to the Admiralty, stressed the need for the rapid completion of ships' installations on account of the shipping situation. The meeting agreed to recommend the institution of a system of payment by results provided this did not involve piece-work which would set one man against another.

Purchase of Mica

The Minister of Supply has made a Direction under the Control of Mica (No. 2) Order, 1942, authorising the acquisition and disposal, without licence, of small quantities of prepared mica or of built-up mica (micanite and the like). The aggregate quantity acquired by any one person from all sources must not exceed £5 in value in a period of one calendar month, and processors who make disposals under the Direction must make a monthly return to the Ministry of Supply in the form set out in the appendix. Inquiries about the Direction should be addressed to the Ministry of Supply, R.M.2C, Carlton House Terrace, S.W.1. Copies of the Direction (No. 1), which came into force on February 4th, may be obtained from the Stationery Office, price 1d.

Production of Hand Tools

A new Order issued by the Ministry of Supply to come into force on March 22nd will prohibit the production of complete hand tools, wooden handles, and hand tools complete except for handles, save under licence from the Directorate of Hand Tools. "Production" means either manufacture or assembly, and a hand tool is defined as any tool not requiring any power other than human power to operate it.

A list of the hand tools to which the Order applies is set out in Section 1 of the Schedule to the Order; in fact, most are included. One important exception to the Order relates to the production of hand tools by any manufacturer for use in his own works by his own workpeople, and not for disposal in the ordinary way of trade.

The underlying purpose behind this control is the standardisation of hand tools for the period of the war, and the elimination of all unnecessary types and sizes, and to provide that only such hand tools as are essential both for Service demands and for the maintenance of the vital needs of the country are produced in such quantities as may be required. The licensing of manufacturers of hand tools represents the first step in co-ordination of production and distribution, and further steps in the way of controlling distribution are under consideration. Manufacturers should apply immediately to the Director of Hand Tools, Ministry of Supply, "Woodthorne," Tettenhall, Staffs, for the necessary form on which to make formal application for a licence, if they have not already received the form.

Copies of the Order, the Control of Hand Tools (No. 2) Order, 1943, may be obtained from H.M. Stationery Office, price 1d.

War Risks Insurance

The Board of Trade, with the approval of the Treasury, has decided that for the period beginning March 3rd, and ending June 2nd next, the rate of premium payable under any policy issued under the Commodity Insurance Scheme shall be at the rate of 2s. 6d. per cent., per month. The monthly and three-monthly policies for a fixed sum and three-monthly adjustable policies hitherto issued will be continued. The new rate is a reduction of 50 per cent. on the rate for the current period.

Mining Machinery in South Africa

Electrical machinery was purchased by the Mines Department of the Union of South Africa in 1941 to the value of £1,537,000. Of this total £402,000 represented South African manufactures. The value of electrical spares and fittings bought was £212,000, of which £70,000 worth was South African.

Temperature Measurement Code

Now that the supply of energy for industrial processes has become one of the limiting factors in our war potential it is particularly opportune that the British Standards Institution should publish a comprehensive code for temperature measurement, the measurement of temperature being essential in the control of energy transformation. The B.S.I. code is the first of its kind published in any country and has involved several years of investigation by a committee of scientists, instrument makers and engineers.

The new code covers the whole range of industrial thermometry starting with the international temperature scale, based mainly on the work of the National Physical Laboratory, and going through mercury thermometers, thermocouples, resistance thermometers and radiation pyrometers of all kinds. A very valuable section deals with the sources of error, and there are also several sections covering special problems of thermometry such as the measurement of the temperature of gases and liquids and the surfaces and interiors of solids.

In the preamble the code is stated to be of a provisional character issued for war purposes, and it will be subject to revision as soon as the situation permits. It has been in use in a number of laboratories and works for some time past on an experimental basis and its value has thus been thoroughly established. Copies of this British Standard (B.S. 1041) may be obtained from the Institution, 28, Victoria Street, S.W.1, price 12s. 6d. post free.

Representation in South Africa

A Johannesburg reader who has connections with mining concerns, and is now in this country, desires to get into touch with British manufacturers of electrical accessories, insulating materials, small motors and transformers, etc., with a view to representing them in South Africa after the war. We shall be glad to forward letters from interested firms.

Patent Action Decision

Mr. Justice Uthwatt delivered his reserved judgment in the Chancery Division last week in an action by the Automatic Coil Winder & Electrical Equipment Co., Ltd., against Taylor Electrical Instruments, Ltd., for an injunction for alleged infringement of a patent used for electricity measuring purposes.

His Lordship said plaintiffs claimed that the defendants had infringed their invention. Defendants, by their defence, pleaded that the invention was common knowledge in regard to the compensating shunt, which plaintiffs claimed as their invention. The evidence satisfied his Lordship that this system of measuring was common knowledge, and he dismissed the action with costs.

Damages for Loss of Forearm

In the King's Bench Division last week a settlement was arrived at in an action by Edwin George Adey, aged nineteen, of Salisbury Road, Manor Park, E., against Standard Telephones & Cables, Ltd. Plaintiff sought to recover damages for personal injuries which he received at the defendants' factory at North Woolwich on December 8th, 1941. He was engaged in the part of the factory where the cables were passed over revolving drums and his case was that his hand was caught in the gear pinion of the machine, which was unguarded at the aperture.

After counsel's opening of the case the parties arrived at a settlement of the action and judgment was entered for Adey for £1,500 and costs.

Price of Table Lamp

At Glasgow Sheriff Court on February 2nd, A. & C. Edelman (1939), Ltd., 185, Howard Street, Glasgow, denied overcharging for an electric table lamp. The charge alleged that the lamp was price-controlled, and that on April 20th last, Edelmans sold it to Glasgow Light House, Ltd., for £2, the basic price being 10s. plus any permitted increases. The defence was that the lamp was not price-controlled until after May, 1942, and that the price regulation Order was unintelligible to the ordinary dealer.

The depute-fiscal who conducted the prosecution, said it had been proved beyond doubt that the lamp cost 8s. and the increase in costs was negligible. There was no evidence, he said, to justify an article that cost 8s. being sold at £2.

Sheriff Walker found the charge proved and imposed a fine of £10. An agent for Edelmans applied for a stated case with a view to an appeal.

More Batteries

The President of the Board of Trade stated this week that the output of cycle lamp batteries for civilian use had been greatly increased. The recent shortage had been due to the necessity for equipping the North African troops. Mr. Dalton also said that although there would be more torch batteries on sale in the next few weeks there should be no extravagant use of torches. The annual consumption of torch and cycle lamp batteries by the civil population was about 180 million.

Unauthorised Extension

At Blackpool recently, Stanley Nice, of St. Heliers Road, was fined 40s. for "unlawfully laying an electric line." The summons followed a householder receiving an electric shock from electric wires in the kitchen. She complained to the Electricity Department, and it was found that the original wiring had been extended without the consent of the Corporation.

Scottish Contractors' Year Book

Paper restrictions have necessitated a reduction in the number of pages in the 1943 edition of the *Year Book* of the Electrical Contractors' Association of Scotland, the principal omission from the new edition being the diary. The main literary features, however, have been retained and the publication is still an invaluable book of reference to all those engaged in the electrical contracting industry in Scotland. It is published from the Association's offices at 55, Frederick Street, Edinburgh, at 3s. (3s. 6d. post free.)

Australian News

Generating plant comprising a Crossley oil engine driving a 100-kVA Laurence, Scott alternator, and three Ruston oil engines driving 30-, 45- and 90-kVA Witton alternators was recently destroyed by a fire at the power house of the Coonabarabran (N.S.W.) Council.

Difficulty has been experienced in obtaining suitable plant to work the deposits of bauxite recently discovered in Victoria. *Tenders* reports that the Ministry of Supply and Development is endeavouring to obtain the necessary equipment from the United States.

The Commonwealth Tariff Board is to make inquiries concerning the post-war reconstruction of secondary industries, and investigations have been started with regard to several types of equipment, including telephone and telegraph apparatus.

Trade Announcement

Frederick Webster, Ltd., Aldwych House, London, W.C.2, who produce materials for the cable and allied trades, announce that they have recently commenced the manufacture of Paris White, the highest form of washed and levigated whiting, at new works in Kent.

Change of Name

Twickenham Electrical Wholesalers, Ltd., has changed its name to Halsey's (Twickenham), Ltd.

Canada's Power Supply

Large Extensions to Meet Wartime Demands

EMPHASIS is laid on the ever-increasing demands of wartime industry in the review of Canadian hydro-electric progress during 1942, published by the Dominion Water and Power Bureau of the Department of Mines and Resources. The rapid development of the country's munitions industry has resulted almost completely from the utilisation of the great resources of developed water power which in peacetime had enabled Canada to advance from an agricultural economy to the position of the third greatest manufacturing country in the British Empire.

Figures of electricity produced at central electric stations reflect the great growth of wartime industry. The output in each of the first ten months of last year was considerably in excess of that in the corresponding months of 1941, and the aggregate for the year is expected to reach a record amount of more than 37,000 million kWh. Important schemes for adding to the available generating capacity are being rushed to completion ahead of schedule and last year new installations totalled 378,600 HP, raising the Dominion's hydraulic development at the beginning of the current year to 9,225,838 HP. To this, construction now in progress will add 1,000,000 HP in the course of the next eighteen months, and even then almost 80 per cent. of Canada's resources will remain for development as demand arises.

Last year an additional 378,600 HP of hydro-electric generating plant was brought into operation in Canada and construction now in progress will add 1,000,000 HP in eighteen months

Ontario and Quebec

A large proportion of Canada's heavy industry war production is located in Ontario whose resources of developed and imported hydro-electric energy have thereby been taxed to the limit and many adjustments as between essential and non-essential uses have had to be made. During 1942 installations totalling 66,900 HP came into operation. The Hydro-Electric Power Commission, which generates 75 per cent. of the power produced in the province completed its second station on the Madawaska River. This plant, at Barrett Chute, has an installation of 56,000 HP. At DeCew Falls an initial installation of 65,000 HP is expected to be in operation this year. The plant will have the second greatest head among those deriving their water supply from the discharge of Lake Erie, and a speedy and economical addition to the power supply of this strategic area will result. Work on the submerged weir being built jointly by Canada and the United States in the Niagara River above the Falls was virtually completed at the end of the year. In the northern part of the province of Ontario active construction was continued by the Commission on the Ogoki River diversion structures which were nearing completion at the end of the year.

Following the addition of a 10,500-HP unit in its Upper Falls station on the Montreal River, the Great Lakes Power Co. added a 10,900-HP unit to its plant at Lower Falls on the same river.

Like Ontario, Quebec has a large share of the heavy industries essential to war production, and the greater part of the Dominion's new hydro-electric plant last year was within this province. Altogether 280,400 HP was commissioned, and much additional construction is in progress. The largest development is that of the Aluminum Power Co. at Shipshaw, some details of which were given in our February 5th issue. Work on this project is well in advance of schedule and the first two 85,000-HP units have been brought into operation. Eight similar units are on order and two of 55,000 HP are to be transferred from the company's Chute-a-Caron station. Additions in progress to the Shawinigan Water & Power Co.'s system include a 40,000-HP unit at the Rapide Blanc generating station and one of 44,500 HP at La Tuque station, both on the St. Maurice River. These units are planned for operation in July.

Other Provinces

In British Columbia the West Kootenay Power & Light Co. (Consolidated Mining & Smelting Co.) has under construction its fifth generating station on the Kootenay River, which will then be fully developed. The station, at Brilliant, is designed for four identical generating units of 34,000 HP each under a head of 85 ft. The units are expected to operate from about 77 ft. in flood conditions to 85 ft. at low flow. The initial installation is intended to be two units.

In Alberta the Calgary Power Co.'s Minnewanka Lake development began full operation on October 15th. It provides power for an extensive electro-chemical munitions industry and comprises a reservoir in Lake Minnewanka and a 23,000-HP generating station on the Cascade River near Anthracite.

The Avon River Power Co., a subsidiary of the Nova Scotia Light & Power Co., completed its Lumsden station at Hell's Gate on the Black River during the year. This station has a 4,500-HP turbine. The Nova Scotia Power Commission commenced the development of a site on the Medway River at Eel Lake and plant of 1,290 HP is expected to be ready soon.

"Cheerful Rationing"

THE February edition of *Cheerful Rationing* is particularly for part-time women workers in industry who find cooking a problem. Several suggestions in this leaflet, which is obtainable from the Electrical Association for Women, 20, Regent Street, London, S.W.1, price 1½d. (2½d. post free) are for meals which can safely be left to cook themselves. Other recipes make use of potatoes instead of flour.

Research in Industry

Facilitating the Interchange of Ideas

THE first Llewelyn B. Atkinson Memorial Lecture was delivered before the ROYAL SOCIETY OF ARTS on February 1st by Dr. P. Dunsheath, who took as his subject "Industrial Research." Previous estimates of expenditure on research in relation to national income were, he said, 1 per cent. in the U.S.S.R., 0·3 per cent. in the United States and 0·1 per cent. in Great Britain. Of the three types of organised research here —industrial, Government and academic— the first made by far the largest contribution and usually had the best equipped laboratories. Electrical industries spent about £1,000,000 per annum in their own laboratories alongside production.

Real research should be freed from routine testing and process problems and have a long-term policy of investigation. The old separation of scientific from industrial research no longer held. Scientific research had some of the characteristics of insurance and this might account for a tendency to co-operation with its spreading of risks and sharing of rewards.

Present Expenditure

Of the establishments maintained out of Government funds administered by the Department of Scientific and Industrial Research (£500,000 per annum, plus a capital sum of £1,000,000) the most important was the National Physical Laboratory, which spent about £100,000 per annum. Outside the control of the D.S.I.R. were the laboratories of such organisations as the G.P.O., the B.B.C. and the war services. After giving particulars of research in other industries, Dr. Dunsheath showed that the expenditure by the electrical industries, expressed as a percentage of the annual turnover, was 0·075 —fourth on the list.

Reference was made to the holding up of new processes by blocking patents—a practice which was not necessarily reprehensible, since a too rapid change-over to new ideas might be wasteful, but it should not be for the wealthy concern to make the decision. Some machinery was required for adjusting on a national basis the competing claims of new and established designs that might have reached the mass-production stage. Where the new idea ought to be developed, the superseded industry might be compensated out of the consequent profits. The usually long time gap between discovery or invention and practical application so often involved heavy expenditure that without adequate protection for the investment the original ideas might not be brought to fruition.

University investigators were often engaged in industrial research. This brought fresh minds to bear on problems and enabled these investigators to keep abreast of new knowledge before it was published. The position of the universities would be a vital factor for consideration in laying down a future policy. Successful collaboration between industry and universities had been promoted by maintenance grants (exceeding £26,000 per annum) sponsored by the D.S.I.R.

Central Record Organisation

A fundamental problem was how to secure the cross-fertilisation of ideas between industrial concerns and between industry and university scientists. The hitherto limited practice of interchanging research staffs should be extended.

Government organisations could not replace industry's own laboratories, but a central co-ordinating body in contact with a technological and patent library would be required to maintain a comprehensive record of all researches in progress and completed. This would shorten the period between the birth of knowledge and its availability for use. Such a body could decide when publication of investigations was desirable in the public interest. It could also formulate new problems and allocate them to suitable investigators. It could also secure public interest in research through the Press. This co-ordination might be effected by a semi-Governmental body similar to the B.B.C. which could grant licences to industrial concerns on condition that they contributed adequately to the advancement of science in their industry.

Dr. Dunsheath concluded by quoting from the Ormesby-Gore Report of 1928 that "if this country is to maintain a sufficient volume of export trade in the future to secure essential imports of foodstuffs and raw materials, research must become a normal activity of every industry and not only a service to it."

Resuscitated on Pole Cross-arm

OUR American contemporary, *Electrical West*, records a case in which a linesman of the Southern California Edison Co. was resuscitated while sitting astride the cross-arm of an overhead line pole. He accidentally came into contact with a live 4,000-V circuit and fell free, hanging head downwards from his safety strap. Another linesman who went to his aid placed him in a sitting position astride the cross-arm and applied artificial respiration until the injured man began to breathe. He was then taken to hospital, where he is stated to be making a satisfactory recovery.

The E.R.A. in 1942

Need for Further Accommodation

WHAT will be involved in post-war reconstruction cannot be foreseen, but it may be expected that co-operation on a larger scale than now may be expected in most directions. There is no doubt that the best work of the British Electrical and Allied Industries Research Association has been done in those spheres in which interests and facilities have been pooled most completely. It is concerned at present only with co-operative research and controls not more than about one-twelfth of the total expenditure on research within the British electrical industry.

Money spent on investigational activity of this kind has increased materially during the 26 years the E.R.A. has been in existence, but it is still less than is expended in some other countries. The work in hand and contemplated will need not less than £150,000 per year to be expended over the first three years after the war, but the Association's laboratory at Perivale in its present form will not be adequate for research on this scale. Land now available is insufficient for adequate extensions and the site is becoming unsuitable owing to growing interference by and with neighbouring activities. The E.R.A. Council has accordingly concluded that a fresh site, larger and more convenient, must be found for the laboratory as well as to provide accommodation for most of the work done at the head office in London.

Work for the Government

Funds now accumulating would enable a start to be made, but adequate financing of the development proposed will require further attention. Income has grown slightly, in part due to new members and contributions; but the major enlargement of both income and expenditure has been caused by the increase in contracts directly concerned with the war effort. They are on a cost basis, but the Association has to finance them until payment is secured.

The volume of work undertaken for Government Departments has considerably exceeded what was foreshadowed for last year. High priority has been given to the testing of industrial gear for flame-proofness. A report has been issued in respect of the first series of gases; the present programme on a second series of industrial gases is expected to be completed in a few weeks time.

Beyond a critical résumé of published information on the subject, war conditions have prevented investigations into better means of storing electrical energy. Similarly investigation has been delayed of the thermal properties of wall coverings with special reference to intermittent space heating, but some results are expected to become available this year. Electric floor heating is being studied as a possible means of providing "background" heat in houses. Some consideration is also being given to local storage heating and to the lagging of water heaters for reducing losses. Two electricity supply undertakings which control water heaters by means of signal impulses superimposed upon the mains have co-operated in making tests regarding the diversity of water heating. In another area continuous recordings are being made of the load on, and temperature of, transformers feeding rural and semi-rural dwellings.

Methods of allocating the standing costs of electricity supply are being specially studied with a view to developing a procedure best suited to modern conditions.

Agricultural Applications

Activities of the rural electrification section have been modified by wartime circumstances. Test distribution lines to farms erected in and since 1940 with the object of providing operating experience and affording a basis for recommendations for British Standard practice for light construction suitable for lines up to 22 kV have given no trouble whatever. The proposed design is cheaper than that of existing lines owing to simplicity and ease of erection. The Electricity Commissioners have passed the draft specification to the British Standards Institution in preparation for publication.

Evidence in report W/T.4 on improvement of load factor in farm grinding (substantiated by experience of the working of subsequent decentralised installations) that low-loaded hammer mills, automatically or semi-automatically controlled, are capable of satisfying substantial grinding requirements has been accepted by the Ministry of Agriculture as a useful contribution to the war effort. A commercial model, complete with electric drive and control, is now in production, the main considerations being small weight and cheapness.

Publication by Reading University is expected shortly of a report on the ultra-violet irradiation of chickens, while an account is in preparation of a sequence of experiments on the heating of beehives at Rothamsted and elsewhere. In addition to the recently announced simplified method of heating hot-beds, promising work has been done on the pre-heating of tomato-house soils by buried wires, in collaboration with University College, Nottingham, and the West of Scotland Agricultural College. The

E.R.A. is associated also with one of the most outstanding experiments in nutrient solution (soil-less) culture at Reading University.

Meter Pivots and Jewels

The comprehensive report foreshadowed on integrating meters (delayed owing to an accident suffered by the investigator) will become available this year. It will now cover investigations of pivots and jewels for instruments as well as energy meters ; in the case of the former it will compare substitute materials with sapphires. Recommendations have been made in respect of the use of glass bearings in certain instruments for the Services, the necessity for correct lubrication of such bearings being emphasised.

In connection with surge phenomena means have been suggested for preventing recurrence of specific system faults, while novel modifications of known methods of investigation include the employment of a special type of potential divider in conjunction with a klydonograph for discrimination between voltages at normal frequency and those of the form of a high-frequency disturbance, as well as the development of a surge counter for use on low-voltage systems.

A method has been evolved for calculating the distribution of the currents which lightning induces in transmission lines. The wave shapes and amplitudes of induced surges have been determined by numerical calculation. Previous attempts to ascertain their characteristics theoretically have usually been based on assumptions that are difficult to justify. More suitable commercial forms of the component parts constituting the E.R.A. surge filter have been designed and tested.

Magnets and Switches

The only ferromagnetic elements are of the transition type, having incomplete inner shells of electrons, which probably accounts for many peculiarities in their behaviour. The unusual structural properties of some metals and alloys are likely to be associated wih their uncommon atomic arrangement. These phenomena have formed the basis of researches conducted under the direction of Prof. Sir Lawrence Bragg at the Cavendish Laboratory, Cambridge, having an important bearing on the cold-working of such metals. An electron microscope that has been acquired should be particularly useful in examining the initial stages of precipitation in alloys.

Special equipment has been used to good effect in continuation of the study of power-arc rupture, with which considerable progress has been made. A novel method of measuring current in the immediate vicinity of its passage through zero is in an advanced stage of development.

When the principal E.R.A. patent on gas-blast circuit-breakers expired in April last year, E.R.A. Patents, Ltd., petitioned for an extension of the normal life of the patent ; a favourable judgment has lately been announced. Further work has been done towards providing a scientific basis for the design of " hard gas " switches and certain models have been tested.

Work on fusible cut-outs has been severely handicapped by loss of staff to the Services, or diversion to war work, but the melting process of a fuse wire up to the incipient stage can now be regarded as satisfactorily defined, so clearing the way for investigation of the arcing process.

Cables

The volume of work in hand on cables and overhead lines may be gauged from the fact that condensed reference to the more important items being carried out under the necessary restrictions of priority requires seventeen headings for tabulation in the annual report.

Recommendations shortly to be made will, it is hoped, permit the current rating of cables in ships to be so adjusted as to afford a greater degree of security and reduce some of the large factors of safety that have sometimes been allowed hitherto.

A sensitive thermionic voltmeter capable of discriminating between AC and fluctuating DC is being developed for research into currents and voltages in buried water mains. With regard to the corrosion of reinforced concrete it has been found that under certain conditions the bond strength is increased by electrolysis without damage to the reinforcement ; attempts are shortly to be made to discover how this effect may be utilised to advantage in practice.

Increasing wartime demand for technical information is reflected in the steadily growing number of inquiries dealt with by the E.R.A. information bureau, which has a card index approaching 30,000 subject references.

" Chris Wilson " Memorial Fund

As the outcome of the widely expressed wish of his relatives, friends, business associates, and employees of the Osram group of factories, a subscription list was inaugurated for the purpose of providing a memorial to the late Mr. Christopher Wilson, a director of the General Electric Co., Ltd. So generous and spontaneous has been the response to the appeal for the original purpose of endowing a cot in the West London Hospital (of which Mr. Wilson was a life governor) that it is now possible to endow both a bed and a cot to his memory, leaving also a substantial balance to be expended at the discretion of the Board of Governors of the West London Hospital on such other permanent equipment as it may decide. The total of the subscriptions amounted to £1,747.

Irish Power Production

Hydro-Electric and Peat Development

SPEAKING on the electricity supply system of Eire to the ARCHITECTURAL ASSOCIATION OF IRELAND, Mr. P. G. Murphy, chief engineer of the Design Department of the Electricity Supply Board, said that during the Parliamentary debates on the Shannon hydro-electric scheme, most of the controversy centred on whether the country could provide a demand for the Shannon's output, which in partial development reached 151 million kWh per annum within three years of the plant going into commission. In six years the demand was doubled and it was trebled in ten years. The output was now 450 million kWh a year.

In a country of such small electricity production as 151 kWh per head of the population it would, Mr. Murphy thought, be conservative to assume that the present output would be doubled in a decade after the war. In an average year the Shannon could produce about 300 million kWh and the Liffey 30 million kWh. The additional requirements at the moment were supplied from the Pigeon House steam station, but any further growth would necessitate the construction of new generating stations.

Harnessing Other Rivers

For some years past the E.S.B. had been investigating the potentialities of various Irish rivers. The most important, after the Shannon, was undoubtedly the Erne. On it there was a fall of about 150 ft. between Lower Lough Erne and the sea at Ballyshannon and a detailed scheme for its development was at present being prepared. The average output would be about 200 million kWh per annum, or about two-thirds of the Shannon output. The next most important rivers appeared to be the Boyne and the Lee. The topography of Eire did not lend itself to the provision of very large storage of water, which could be used in dry periods, and it was quite impossible to avoid a reduction of the output of hydro-electric plant in exceptionally dry spells. The contribution obtainable from water storage could be gauged from the fact that the total storages on the Shannon and Liffey were only equivalent, when full, to about 35 million kWh. Under such conditions sufficient steam generating plant must be available to cover the deficiency of the hydro-stations.

The conclusion to be drawn was that hydro-electric development of the Irish rivers alone was not a complete solution to the problem of providing for increases in electricity demand. On the other hand, it must be remembered that since the Shannon hydro-electric station went into commission in 1929 it had supplied 70 per cent. of the total electricity requirements of the country in spite of the fact that in a number of years the flow in the River Shannon was considerably below the average.

Dealing with fuel-burning stations, Mr. Murphy said that the utilisation of coal presented no special problems. Native coal, which was mainly anthracite, or semi-bituminous, could be utilised efficiently in boilers designed for that purpose. The more recently installed boiler plant in the Pigeon House station was designed and constructed for the use of native anthracite. The utilisation of peat as fuel for the generation of electricity presented many technical problems. The calorific value of peat (air dried to about 30 per cent. moisture, which was a good value for Irish conditions) was about half that of coal. It was a bulky fuel, a ton occupying about twice the space required for a ton of coal. Consequently, for the same heat content the volume of machine-cut peat fuel was about four times that of coal. This characteristic made the storage, handling and burning of peat completely different problems from those of coal. From their own investigations he could say that, if peat fuel of reasonable quality was available, it could be utilised for the generation of electricity with as high an efficiency as coal under similar circumstances. Provided the peat was adequately dried and that sufficient quantities were available, its economic price per ton was approximately half the corresponding price of coal.

A Post-war Peat Station

The erection of a peat-burning generating station had already been decided upon, but the war had held up the work, which would proceed immediately the purchase of heavy engineering plant became again possible. The station would be situated at Portarlington, directly adjoining the Clonsast Bog, now in the process of mechanical development by the Turf Development Board. The peat fuel would be produced by electrically driven excavators and it was estimated that the annual production would be approximately 120,000 tons of air-dried peat fuel of about 30 per cent. moisture. That quantity would correspond to about 90 million kWh of electricity per annum.

Mr. Murphy, in conclusion, said that if his estimate of the increase in demand for electricity after the war was correct, then the next decade should see the construction of several new generating stations, possibly two hydro-electric and two steam.

ELECTRICITY SUPPLY

Waste-Heat Power. Reigate Rebate.

Accrington. — LIGHTING CONTROL. — The lighting superintendent has been authorised to co-operate in the installation of a remote control system for use after the war.

Barrow-in-Furness.—WASTE-HEAT UTILISATION. —The borough electrical engineer reported to the Electricity Committee on negotiations with the Electricity Commissioners, the Central Electricity Board and the Millom & Askam Hematite Iron Co., Ltd., with regard to the acquisition by the Committee of waste-heat supplies of electricity from the Millom ironworks. The Committee agreed in principle that such waste heat should be absorbed with a view to saving coal, but considered that the price determined by the Electricity Commissioners was inequitable and that the Commissioners should be asked to review it. The Committee expressed the opinion that the price should be 0·15d. per kWh, but agreed in the meantime to pay 0·3d. per kWh pending a final settlement.

FLUORESCENT LIGHTING.—The Town Council has decided to have fluorescent lighting at the transport depot. Sanction has been received to a loan of £4,376 for extensions of the electricity supply.

Birkenhead.—APPLICATION FOR REBATES.—The borough treasurer submitted to the Electricity Committee recently a list of tenants of business premises who sought rebates in consideration of their windows being boarded up on account of war damage. It was decided that as it was possible for the glass windows to be replaced no further reduction could be made in the existing charges. The electrical engineer was, however, asked to submit a report on the matter.

Blackburn.—SUBSTATION SWITCHGEAR.—The Town Council on February 4th decided to make application to borrow £2,600 for the replacement of the 6·6-kV switchgear at two substations.

Chesterfield.—ILLUMINATION OF HALT SIGNS.—The borough engineer reported to the Highways Committee that the divisional road engineer had stated that the Minister of War Transport had no objection to the halt signs being directly illuminated and the cost incurred thereby would be accepted as a charge against the "aids to movement" expenditure in the case of all roads. The Committee arranged for the Electricity Department to provide such illumination.

Glasgow.—IMPROVEMENTS AT GOVAN.— A special sub-committee of the Corporation which has been considering the output of electricity from the Govan refuse works has agreed that an additional dust conveyor shall be provided and the capacity of the present conveyor increased, at an estimated cost of £1,500, and that provision shall be made at the Kelvinhaugh works for the treatment and disposal of additional refuse from Govan at a cost of £3,500. The whole question of the output of electricity from the Govan works is to be further investigated.

Kettering.—STREET LIGHTING.—The modified system of street lighting is to be extended to Barton Road where the existing lamps are at present unlighted.

London.—BULK SUPPLY CHARGES.—Bermondsey Electricity Committee has agreed to an increase of 5 per cent. in the charges for bulk supply by the London Electric Supply Corporation, Ltd.

SOUTHWARK.—The Electricity Committee is seeking sanction to borrow £1,250 for a supply to business premises in Larcom Street and Brandon Street.

Reigate.—SUBSTANTIAL REBATE.—A £12,000 "gift" to electricity consumers in the borough was announced by Alderman W. L. Lorkin, chairman of the Electricity Committee, at a meeting of the Town Council on Saturday. Alderman Lorkin recalled that at about this time last year the Committee appealed to consumers to refrain from using electric radiators between 8 and 9.30 a.m., the peak load period at that time. The response was so good that they were able to give a rebate of 20 per cent. on the last quarter's accounts. By good management, under-spending and economies, they had exceeded their estimated profits this year by a considerable amount, enabling the Corporation to make a gift to its electricity users of over £12,000. The rebate now being given represented a discount of 33⅓ per cent. from the last quarter's account in the current financial year. At the present time, he said, their tariffs were among the lowest in the country, and lower than any of those in the surrounding districts.

Rotherham.—TARIFF ADJUSTMENT VETOED.—The Electricity Committee reports that the Electricity Commissioners have refused to sanction the proposal of the Committee for the adjustment of charges to meet the increased cost of fuel, but will reconsider the matter when the accounts for the year are available.

NEW PLANT.—The Electricity Committee is to lay an additional feeder cable with reactor. It also proposes to install an additional grab for the ash plant and an air heater.

Overseas

Austria. — STANDARDISING CHARGES. — Gauleiter Hugo Jury recently announced that the electricity supply in the entire Niederdonau (Lower Danube) region, including every peasant settlement, was to be on equal terms and at the lowest possible price. For this reason the Gauwerke A.G. had been founded in Niederdonau. By closing down unprofitable power plants and combining districts it had, he said, been possible to make the Reichsgau Niederdonau the first region with a common supply. The whole power industry had been amalgamated into a single National Socialist enterprise. In an article on the same subject *Der Vierjahresplan* states that the difficulties in the supply of electricity in the region had been very great. At present 950 villages or communities were still without electricity. Charges

were very diverse, and one supplier alone had 124 different tariffs.

Denmark.—LIGHTING RESTRICTION.—Lighting for advertising purposes or shop window display is now banned in Denmark because of the fuel shortage, states the newspaper *Tidningen.* A 40 per cent. reduction in shop and restaurant lighting and heating has also been ordered.—*Reuter.*

Eire.—THE LIFFEY SCHEME.—It is forecast in the Irish Press that the long-delayed Liffey hydro-electric and water supply scheme will commence to generate electricity in April next. Our Dublin correspondent learns from the Electricity Supply Board, however, that it is not yet possible to give the date when the plant will be commissioned with any certainty, although every effort is being made to accelerate the work.

During recent months, by suitable adaptations of materials, considerable progress has been made. One of the 15,000-kW generating sets is now erected, as is also the 4,000-kW set at Golden Falls. The second 15,000-kW plant has been delivered, but all the ancillary equipment has not yet arrived.

France.—FIRE AT POWER STATION.—A fire which recently occurred at the Genissiat plant is said to have been due to a short-circuit. Considerable damage was done.

South Africa.—WASTE-HEAT PLANT.—An interesting passage in the annual report of the city electrical engineer of Durban (Mr. C. Kinsman, M.I.E.E.) is that referring to a waste-heat generating plant at Hulett's Refineries, Rossburgh. This plant is owned jointly by the municipality and the refinery company and during the year ended July 31st last 17·4 million kWh was produced, of which 7·4 million kWh was used for refining and the remainder was fed into the public supply system.

INCREASED SALES.—During the year the Electricity Department sold altogether 236·6 million kWh, compared with 222·2 million kWh in 1940-41, an increase of 6·5 per cent. Although the most considerable development (30 per cent.) was in supplies to Government Departments, there were advances in all other categories except street lighting inside the city. A black-out was put into force six weeks before the close of the year and daylight saving a few days before the end of the year, so that the effect of these is only reflected to a very small extent. The number of consumers at the end of the year was 41,982, an increase of 1,389.

United States.—LARGE TURBO-GENERATOR.—The *Electrical World* reports that a 125,000-kW turbo-generator has been installed at the Marion station of the Public Service Electric & Gas Co., Jersey City.

TRANSPORT

Belfast.—TROLLEY-BUS DIVERSION.—In order to relieve traffic congestion in the centre of the city the Transport Committee has decided to divert three of the trolley-bus services by Chichester Street and May Street. Feeder cables and overhead equipment are estimated to cost £3,800.

Ceylon.—OPTION TO PURCHASE TRAMWAYS.—The Colombo Electric Tramways & Lighting Co., Ltd., has been informed that the Municipality intends to exercise its option to acquire the tramway undertaking as from November 26th next.

France.—INAUGURATION OF TROLLEY-BUSES.—It has been announced on the Paris radio that the first trolley-bus service in the city commenced on January 16th.

Hull.—LOUDSPEAKERS ON TROLLEY-BUSES.—The general manager having reported to the Transport Committee that loudspeaker equipment in use at Doncaster had been inspected, the Committee has decided that two sets of this type shall be purchased for trial purposes on the Corporation's trolley-buses.

Newcastle-on-Tyne.—ANNOUNCING STOPPING PLACES.—The City Transport and Electricity Committee is not to act upon a suggestion that microphones should be installed in drivers' cabins of trolley-buses, etc., for the purpose of announcing stopping places to passengers, especially in the black-out. Mr. H. C. Godsmark, general manager of the undertaking, said that the idea had been suggested in other areas but had not been acted upon. He thought the plan was impracticable. In the first place there was the difficulty of obtaining the necessary materials for the work and, secondly, if the plan was adopted every driver would have to undergo a course in pronunciation. He pointed out that although many words seemed easy to say, they would come through a microphone only as a blurr.

TRADE MARK APPLICATIONS

RECENT applications for British trade marks include the following, objections against which may be entered within a month of February 3rd:—

SPEEDWELL. No. B621,114. Class 6. Welding rods of common metal.—Albert Langston Haggerty, trading as Haggerty, Lawrence & Co., 43, Cadwallon Road, New Eltham, London, S.E.9. (Advertised before acceptance).

TOWER. No. 621,295. Class 6. Welding wire and welding rods, all of common metal. Also 621,296. Class 7. Electric and gas welding machines and parts thereof not included in other classes.—A. S. Young & Co., Ltd., "Tower" Works, Woodside Lane, North Finchley, London, N.12. Both to be associated with No. 621,294 (3384) i and another.

SUPERMEL. No. 620,041. Class 9. Electric wires and electric cables.—W. T. Henley's Telegraph Works Co., Ltd., Milton Court, Westcott, Dorking, Surrey.

METRIGAP, No. 620,465; and TRIGATRON, No. 620,467. Class 9. Intermittent electric discharge devices and thermionic and electronic pulse generators, and parts (not included in other classes) of all the said goods.—Metropolitan-Vickers Electrical Co., Ltd., 1, Kingsway, London, W.C.2.

PYROBAR. No. B620,958. Class 11. Electric heating elements, included in Class 11.—British Thomson-Houston Co., Ltd., Crown House, Aldwych, London, W.C.2.

PIGETUBE. No. B619,727. Class 17. Tubing of sleeving for electric insulation.—Pirelli-General Cable Works, Ltd., 343-5, Euston Road, London, N.W.1. To be associated with No. 610,602 (3240) xvii and another.

FINANCIAL SECTION

Company News. Stock Exchange Activities.

Reports and Dividends

Yorkshire Electric Power Co.—A copy of the speech to be given by the chairman, Sir Geoffrey Ellis, Bt., at the annual meeting on February 15th has been circulated with the report of the directors for 1942. In it the chairman states that production has expanded during the year and in every way the company's position has grown steadily stronger. He records with regret that Col. H. C. Fraser, the general manager, is not yet sufficiently recovered to return to full-time work, but expresses the hope that, with the coming of spring, Col. Fraser will soon be back in harness.

Referring to recently published "planning" reports, the chairman says that the Uthwatt Report does not for the time being directly concern the company's activities. The majority Scott Report makes certain suggestions in relation to power distribution and consumer prices which he considers are not justified by any evidence disclosed. A minority report deals faithfully with these points. The industry, he says, is only too willing to help in arranging a future which will assist production generally and prevent unemployment, but it asks that before far-reaching changes are sanctioned a thorough practical examination of them shall be made. A much keener appreciation is needed, he believes, of the hard realities of the future than either political leaders or planners have yet given us.

As already announced, the directors recommend that the dividend on the ordinary stock for the year shall be maintained at 8 per cent. by a final distribution of 5 per cent.

The English Electric Co., Ltd., in a preliminary statement, reports that after providing for taxation the profit for 1942 is £407,560 (including dividend receivable from D. Napier & Son, Ltd.) as compared with £362,604 for 1941. An ordinary dividend of 10 per cent. for the year is recommended, the same as for the previous year.

Westinghouse Brake & Signal Co., Ltd.—reports a profit for the year ended September 30th, after providing for depreciation and tax, of £167,711, as compared with £143,939 for the preceding year. After deducting directors' fees the net profit is £164,711 (against £141,269). Contingencies reserve receives £80,000, and staff pensions £10,000. The dividend for the year is maintained at 10 per cent., but in addition a bonus of 2½ per cent. is paid. The balance carried forward is £95,836 (against £91,273 brought in).

The Carrier Engineering Co., Ltd., reports a trading profit of £98,933 for the year to June 30th, an increase of £13,124 as compared with the preceding year. With investment and other income the total profit is £103,414. Depreciation absorbs £12,948 and after deducting patent fees the net profit is £90,169, an increase of £8,618. From this £22,568 is deducted for taxation, leaving a balance of £67,600. An interim dividend of 25 per cent., less tax, has been paid on the ordinary shares, and the directors do not recommend a further dividend in respect of the year. For the previous year 25 per cent. was distributed. The balance carried forward is £103,552 an increase of £23,350.

R. A. Lister & Co., Ltd.—Speaking at the annual meeting on February 5th Mr. Percy Lister (chairman) mentioned that the share value of £344,216 in subsidiary companies included the company's holdings in Blackstone & Co., Ltd., and associated and subsidiary companies in the United States, Argentina, Canada and Australia. The capital invested in subsidiary companies in enemy-occupied territories had been written off. The output had increased substantially with only a small proportional increase in the number employed.

Scophony, Ltd.—A *Reuter* message from New York says that Paramount Pictures and General Precision Equipment Corporation, together with Scophony, Ltd., London, have formed Scophony Corporation of America, which controls the American rights of patents of the "supersonic" method of television developed in Great Britain. Paramount Pictures and General Precision Equipment Corporation hold 50 per cent. of the stock, while Scophony, Ltd., and other interests hold the balance.

The Bognor & District Gas & Electricity Co. is paying interim dividends on the additional "A" shares of 3¾ per cent., on the consolidated "A" shares of 3¾ per cent., on the original "B" shares of 4¼ per cent., and on the new consolidated shares 3¾ per cent. (all unchanged).

The Power Securities Corporation, Ltd., announces a net profit of £50,663 for 1942 (after meeting taxation), against £52,035 for 1941. The dividend is again 6 per cent.

Thomas Tilling, Ltd.—From a net profit of £535,391 (against £524,495) a final dividend of 5 per cent., again making 10 per cent., is being paid. £100,000 is transferred to general reserve, as last year.

British Ropes, Ltd., are to pay a final ordinary dividend of 7½ per cent., again making 12½ per cent. for the year.

New Companies

Armin Spiegel, Ltd.—Private company. Registered January 28th. Capital, £100. Objects: To carry on the business of manufacturers of, and dealers in, machinery, electric motors, apparatus and equipment for lighting, heating, freezing, telegraphy, telephony, television and other purposes, etc. A. Spiegel, 43, Chardmore Road, N.16, is the first director. Registered office: Devonshire Chambers, Bishopsgate, E.C.2.

Skilton & West, Ltd.—Private company. Registered January 28th. Capital, £5,000. Objects: To acquire the business of electrical, marine and general engineers carried on by R. L. Skilton and R. West at East Street and Woodrolfe Road, Tollesbury, Essex, as Skilton & West. Directors: R. L. Skilton, Woodrolfe Road, Tollesbury, Essex; R. West, East Street,

Tollesbury, and three others. Solicitors: Wittey, Denton & Pawsey, 8, East Stockwell Street, Colchester.

G. H. Greaves, Ltd.—Private company. Registered January 22nd. Capital, £1,000. Objects: To carry on the business of manufacturers of, and dealers in, radio and television apparatus, gramophones, electric accumulators, batteries, wireless aerials and accessories, electrical goods, etc. Directors: G. H. Greaves and Mrs. L. M. C. Greaves, both of Reading Road, Yateley, Hants. Secretary: G. H. Greaves. Registered office: Reading Road, Yateley.

M.G.K. Engineering Co., Ltd. Private company. Registered January 9th. Capital £1,000. Objects: To acquire the business of an electrical engineer carried on by G. Mason at Compton Road, Erdington, Birmingham, and to carry on the business of electrical, wireless and mechanical engineers, etc. Directors: G. Mason, 90, Caversham Road, Kingstanding, Birmingham, and F. G. Ketelby, 14, Kelmscott Road, Harborne, Birmingham. Registered office: Gazette Buildings, Corporation Street, Birmingham.

Companies' Returns

Statements of Capital

South London Electric Supply Corporation, Ltd.—Capital, £750,000 in 50,000 6 per cent. cumulative preference and 700,000 ordinary shares of £1. Return dated April 7th (filed August 1st). 30,000 preference and 533,520 ordinary shares taken up. £290,000 paid on 30,000 preference and 260,000 ordinary shares. £273,520 considered as paid on 273,520 ordinary shares. Mortgages and charges: £300,000.

Oriental Telephone & Electric Co., Ltd.—Capital, £900,000 in £1 shares (600,000 ordinary and 300,000 preference). Return dated September 9th. 570,199 ordinary and 188,791 preference shares taken up. £479,918 10s. paid, including £12 10s. paid on 50 ordinary shares forfeited. £279,084 considered as paid. Mortgages and charges: Nil.

Reason Manufacturing Co., Ltd.—Capital, £52,500 in 200,000 preference and 10,000 ordinary shares of 5s. Return dated August 25th. 161,260 preference and 10,000 ordinary shares taken up. £19,664 5s. paid on 78,657 preference shares. £23,150 15s. considered as paid on 82,603 preference and 10,000 ordinary shares. Mortgages and charges: £20,000.

H. Church & Co. (Essex), Ltd.—Capital, £7,000 in £1 shares. Return dated November 3rd. All shares taken up. £7,000 paid. Mortgages and charges: £3,000 (debentures registered September 17th, 1937).

Siemens-Schuckert (Great Britain), Ltd.—Capital, £30,000 in £1 shares. Return dated August 6th. 29,405 shares taken up. £29,405 paid. Mortgages and charges: £6,798 15s. 7d.

Asea Electric, Ltd.—Capital, £250,000 in 250,000 shares of £1 each. Return dated August 24th. All shares taken up. £250,000 paid. Mortgages and charges: Nil.

Ismay (New Process), Lighting, Ltd.—Capital, £10,000 in £1 shares. Return dated December 31st, 1941 (filed October 31st, 1942). All shares taken up. £10,000 paid. Mortgages and charges: Nil.

Bognor Regis Rediffusion Service, Ltd.—Capital, £10,000 in 10,000 shares of £1 each. Return dated August 18th. 7,500 shares taken up. £7,500 paid. Mortgages and charges: Nil.

Invincible Electrical Engineering Co., Ltd.—Capital, £1,000 in 1,000 shares of £1 each. Return dated September 2nd. 400 shares taken up. £400 paid. Mortgages and charges: Nil.

Mortgages and Charges

E. Dyne & Co., Ltd.—Mortgage on proceeds of contract, dated January 20th, 1943, to secure all moneys due or to become due from the company to Midland Bank, Ltd.

Fusarc Welding Co., Ltd.—Mortgage on leasehold land and premises at Icknield Way, Letchworth, with machinery and fixtures, dated January 13th, 1943, to secure all moneys due or to become due from the company to Midland Bank, Ltd.

Electrocraft, Ltd.—Charge on freehold hereditaments known as 15, High Road, Wembley, dated January 14th, 1943, to secure all moneys due or to become due from the company to Barclays Bank, Ltd.

Carrington & Button, Ltd.—Satisfaction in full on December 30th, 1942, of charge dated May 2nd, 1938, and registered May 16th, 1938.

Receiver Released

Champion Radio Valve Corporation, Ltd.—Jacob Lewin, of 201, Regent Street, W.1, ceased to act as receiver on January 21st, 1943.

Meeting of Creditors

Electrical Utilities, Ltd.—A meeting of creditors was to be held on Wednesday last at the Incorporated Accountants Hall, Victoria Embankment, London, W.C.2, for the purpose of receiving a statement of affairs, nominating a liquidator and dealing with any other matters arising under sections 238 and 240 of the Companies' Act, 1929.

Bankruptcies

H. P. Ansell, trading in partnership with others as H. P. Ansell & Partners, and also trading in partnership with others as Engineering Services, at First Avenue House, High Holborn, London, and lately trading in partnership with others as H. P. Ansell & Partners, at City Chambers, Broad Street, Birmingham.—Last day for receiving proofs for dividend, February 17th. Trustee, Mr. L. A. West, Bankruptcy Buildings, Carey Street, London, W.C.2, Senior Official Receiver.

E. G. Williams, wireless and electrical dealer, 37, High Street, Brownhills, near Walsall.—Order made December 10th, 1942, granting discharge subject to bankrupt consenting to judgment being entered against him for £50, together with £1 10s. costs of judgment. (£51 10s. paid to Official Receiver in lieu of entering judgment).

STOCKS AND SHARES

TUESDAY EVENING

STOCK Exchange markets are, for the time being, at the mercy of conflicting factors. Evidence of abundance of capital awaiting investment is more obvious than a readiness to put it into stocks and shares. The " Wings for Victory " weeks are close enough to make their influence felt. Home Railway stocks went dull on the fear of a possible strike ; when this was dissipated, the prices illogically gave way further still. The effect of Russia's wonderful successes was, from the merely mundane point of view, countered by a shade of disappointment at the slow character of the advance in Tunisia. Other cross-currents could be quoted to explain, excuse or justify the relapse of Stock Exchange markets into a sluggish state as different as possible from the lively activity witnessed last month. Prices of speculative issues are dull, but those of the purely investment securities give no indication of receding from the high levels to which they have attained.

Railway Dividend Outlook

The Home Railway dividend season begins on Friday in this week, when the London Midland & Scottish will open the declarations. The London Passenger Transport Board will follow about a week later with its announcement of the dividend on the " C " stock. This time last year, the Board distributed $2\frac{7}{8}$ per cent. but it is hoped, this time, for a return to the 3 per cent. paid in respect of 1941. In advance of this, the stock has been recently rising, until to-day at 60 it stands 20 points higher than the price of a year ago.

The published figures of traffics show that the Home Railway companies' earnings have gone ahead by leaps and bounds, and that the bargain made between the Government and the railways is greatly to the advantage of the former. The rise in traffics is due, of course, mainly to carriage of war materials. To that extent, the increase in receipts should be diverted to the national effort.

Post-War Prospectors

Investment is now definitely looking forward to what is likely to happen in the world of finance after the war. Various planning schemes help to focus attention upon the matter and, while investment has vaguely endeavoured to visualise what may be expected to develop in various branches of industry when peace comes, it is only lately that practical steps have been started, on the part of some capitalists, to re-arrange their lists of securities in the light of post-war possibilities. The avowed intention of investment is to look ahead as far as possible, with the idea of consolidating interests into stocks and shares of companies which are deemed most likely to benefit from the return of peace conditions. The Chancellor of the Exchequer recently sounded a note of warning against the indulgence of extravagant optimism with regard to post-war prospects. Sir Kingsley Wood cherishes no illusions on this subject.

A Telephone Line

Ten thousand Telephone & General Trust ordinary shares have come on offer at 29s.; a larger line of these shares than usually comes to market. The company has paid 8 per cent. dividends each year since 1930, and at 29s. the yield is $5\frac{1}{2}$ per cent. The company is associated with British Insulated Cables, Ltd., and the Automatic Telephone & Electric Co. It forms part of an all-British group in the electrical and communications field. About 79 per cent. of its investments are in Great Britain and the Empire. War conditions may lead, of course, to loss of dividends and the depreciation of investment values, but the company occupies a strong financial position. Its holdings of British Government securities amount to £133,000. Sir Alexander Roger is the chairman and managing director.

Further Price Gains

A proportion of eight or ten price gains to one loss, cannot be expected to continue for long at a time. The record, in this respect, of the last few weeks has been succeeded by less aspiring conditions, but the rises still outnumber the falls. Fluctuations in the current list are fewer, and of no great consequence. Indeed, there are not many which call for detailed comment. Callender's stand out with a rise of a florin. This raised the price to 80s. 9d. and automatically diminished the yield —on the basis of the present-paid 15 per cent. dividend—to £3 13s. 6d. per cent. Henley's are a trifle harder at 25s. 9d., at which price the return is £3 17s. 6d., the same as the income from British Insulated at to-day's quotation. Johnson & Phillips, another good feature, have put on 2s. 6d., and at the improved figure of 66s., the yield is £4. 11s. per cent. General Electrics further hardened to 87s. 6d., Reyrolles to 65s. Lucas have rallied to 70s. and Murex are $\frac{1}{8}$ better at $5\frac{1}{4}$. Strand Electrics at 7s. 3d. are 1s. to the good. Thorn Electrics at 19s. 3d. have gained the pence.

Miscellaneous Matters

Rises of a shilling each have occurred in the ordinary shares of various electricity supply companies. These include both the Yorkshire undertakings, North Eastern and Metropolitan. Bournemouth & Poole are 2s. higher at 60s., on talk of possible (if unlikely) dividend increase. Electric Finance & Securities at 51s. have risen 2s. City Lights & County of London are harder. London Power 5 per cent. debenture is up a point to

(*Continued on page* 236)

ELECTRICAL INVESTMENTS

Prices, Dividends and Yields

Company	Dividend Previous	Dividend Last	Middle Price Feb. 9	Rise or Fall	Yield p.c. £	s.	d.
Home Electricity Companies							
Bournemouth and Poole	12½	12½	60/-	+2/-	4	3	4
British Power and Light	6	6	29/6	..	4	1	4
City of London ..	7	7	32/-	+6d.	4	7	6
Clyde Valley ..	8	8	41/6	..	3	17	0
County of London	8	8	42/-	+6d.	3	16	2
Edmundson's:							
7% Pref. ..	7	7	34/-	..	4	2	4
Ord.	6	6	29/-	..	4	2	9
Elec. Dis. Yorkshire	9	9	44/6	+1/-	4	1	0
Elec. Fin. and Securities ..	12½	12½	51/-	+2/-	4	18	1
Elec. Supply Corporation ..	10	10	46/6	..	4	6	0
Isle of Thanet ..	2	Nil	16/-	..		—	
Lancs. Light and Power	7½	7½	37/6	..	4	0	0
Llanelly Elec. ..	5½	5½	22/6	..	4	17	9
Lond. Assoc. Electric	4½	4	24/-	..	3	6	8
London Electric ..	6	6	27/-	..	4	9	0
London Power Red. Deb. ..	5	5	105½	+1	4	14	7
Metropolitan E.S.	8	8	42/-	+1/-	3	16	2
Midland Counties	8	8	41/6	..	3	17	0
Mid. Elec. Power ..	9	9	44/-	..	4	1	9
Newcastle Elec. ..	7	7	31/-	..	4	10	5
North Eastern Elec. Ordinary ..	7	7	35/-	+1/-	4	0	0
7% Pref. ..	7	7	34/6	..	4	1	2
Northampton ..	10	10	47/6	..	4	4	0
Notting Hill 6% Pref. (£10) ..	6	Nil	9¾	..		—	
Northmet Power: Ordinary ..	7	7	39/6	..	3	11	0
6% Pref. ..	6	6	32/-	+6d.	3	15	0
Richmond Elec. ..	6	6	27/-	..		—	
Scottish Power ..	8	8	41/-	..	3	18	0
Southern Areas ..	5	5	23/6	+6d.	4	5	0
South London ..	7	7	26/-	..		—	
West Devon ..	5	5	22/6	..	4	9	0
West Glos. ..	4½	3½	21/6	..	3	5	2
Yorkshire Elec. ..	8	8	42/-xd	+1/-	3	16	2
Overseas Electricity Companies							
Atlas Elec. ..	Nil	Nil	5/-	..		—	
Calcutta Elec. ..	7*	7*	35/-	+6d.		—	
Cawnpore Elec. ..	10	10	28/-	+6d.	7	2	10
East African Power	7	7	31/-	..	4	10	4
Jerusalem Elec. ..	7	5	24/-	+6d.	4	3	4
Kalgoorlie (10/-) ..	7½	5	9/-	..	5	11	1
Madras Elec. ..	6*	4*	24/6	..		—	
Montreal Power ..	1½	1½	29	..	5	3	5
Palestine Elec. "A"	Nil	4*	31/-	..	2	11	8
Perak Hydro-elec.	6	7	9/6	..		—	
Shawinigan Power	83cts.	90cts.	19½	−½		—	
Tokyo Elec. 6% ..	6	6	19½	−1		—	
Victoria Falls Power	15	15	78/9	..	3	16	4
Whitehall Inv. Pref.	5	5	23/-	..	4	7	0

Company	Dividend Previous	Dividend Last	Middle Price Feb. 9	Rise or Fall	Yield p.c. £	s.	d.
Public Boards							
Central Electricity: 1955-60 (Civil Defence) ..	—	3	99xd	..	3	0	7
1955-75 ..	5	5	116	..	4	6	2
1951-73 ..	4½	4½	108	..	4	3	4
1963-93 ..	3½	3½	104	..	3	7	3
1974-94 ..	3¼	3¼	101	..	3	4	4
London Elec. Trans. Ltd.	2½	2½	96½	..	2	11	10
London & Home Counties 1955-75	4½	4½	110	..	4	1	10
Lond. Pass. Trans.: A	4½	4½	123½	−1	3	13	0
B	5	5	121½	−1	4	2	4
C	3	2½	60	..	4	15	4
West Midlands J.E.A. 1948-68 ..	5	5	110	..	4	11	0
Telegraph and Telephone							
Anglo-Am. Tel.: Pref.	6	6	112½xd	+1	5	6	2
Def.	1½	1½	29	..	5	3	5
Anglo-Portuguese	8	8	25/6	..	6	5	6
Cable & Wireless: 5½ Pref. ..	5½	5½	113	+½	4	17	4
Ord.	4	4	76½	−1½	5	4	7
Canadian Marconi $1	Nil	4cts.	7/3	−6d.	2	8	0
Globe Tel. & Tel.: Ord.	8¼*	5*	33/-	+6d.	3	0	6
Pref.	6	6	28/-	..	4	5	9
Great Northern Tel.: (£10)	Nil	Nil	24½	+1½		—	
Inter. Tel. & Tel. ..	Nil	Nil	7	..		—	
Marconi-Marine ..	7½	7½	32/6	+6d.	4	12	4
Oriental Tel. Ord.	16	10	39/-	..		—	
Telephone Props.	6	Nil	14/-	+3d.		—	
Tele. Rentals (5/-)	10	10	11/-	−3d.	4	11	0
Traction and Transport							
Anglo Arg. Trans.: First Pref. (£5)	Nil	Nil	5/-	+1/-		—	
4% Inc. ..	Nil	Nil	14	+½		—	
Brit. Elec. Traction: Def. Ord. ..	45	45	1100	..	4	1	9
Pref. Ord. ..	8	8	170	..	4	14	2
Bristol Trams ..	8	10	50/6	..	3	19	1
Brazil Traction ..	$½	$1	23½	−1		—	
Calcutta Trams ..	8	5½	21/6	+1/6	5	2	4
Cape Elec. Trams	5	5	22/6	..	4	9	0
Lancs Transport ..	10	10	43/3	..	4	12	4
Mexican Light: 1st Bonds ..	5	5	97½	−1½	5	2	7
Rio 5% Bonds ..	5	5	103½	..	4	16	6
Southern Rly.: 5% Prefd. ..	5	5	78	..	6	8	2
5% Pref. ..	5	5	117	−½	4	5	6
T. Tilling	10	10	53/9	..	3	14	4
West Riding ..	10	10	40/-	..	5	0	0

(*Continued on next page*)

*Dividends are paid free of Income Tax

Company	Dividend Previous	Dividend Last	Middle Price Feb. 9	Rise or Fall	Yield p.c. £ s. d.
Equipment and Manufacturing					
Aron Elec. Ord. ..	7½	10	40/–	..	5 0 0
Assoc. Elec.:					
Ord.	10	10	50/6	..	3 19 0
Pref.	8	8	40/–	+1/–	4 0 0
AutomaticTel.& El.	12½	12½	55/6	..	4 10 0
Babcock & Wilcox	11	11	50/6	..	4 7 2
British Aluminium	10	10	49/6	..	4 1 0
British Insul. Ord.	20	20	5 7/16	..	3 17 3
British Thermostat (5/–)	18½	18½	17/6	..	5 5 9
British Vac. Cleaner (5/–)	10	15	21/6	..	3 9 9
Brush Ord. (5/–)	Nil	6	7/9	..	3 17 5
Callender's ..	15	15	80/9	+2/–	3 13 6
ChlorideElec.Storage	15	15	76/3	..	3 18 9
Cole, E. K (5/–)	7	10	21/3	..	2 7 0
Consolidated Signal	17	17	106/3	..	3 4 5
Crabtree (10/–) ..	17½	17½	38/6	..	4 11 0
Crompton Parkinson Ord. (5/–) ..	30	20	26/–	..	3 17 0
E.M.I. (10/–) ..	6	6	22/–	+6d.	2 14 9
Elec. Construction	10	10	42/6	..	4 14 1
Enfield Cable Ord.	12½	12½	58/–	..	4 6 0
Elecl. Switchgear (10/–)	10	10	20/–	..	5 0 0
English Electric ..	10	10	49/6	..	4 1 0
Ensign Lamps(5/–)	25	25	18/9	..	6 13 4
Ericsson Tel. (5/–)	22*	20*	47/6	..	2 2 2
Ever Ready (5/–)	40	40	39/–	..	5 2 7
Falk Stadelmann	7½	7½	26/–	..	5 15 5
Ferranti Pref. ..	7	7	28/9	..	4 17 5
G.E.C.:					
Pref.	6½	6½	33/3	..	3 18 4
Ord.	20	17½	87/6	+6d.	4 0 0
Greenwood & Batley	15	15	36/6	..	8 4 4
HallTelephone(10/–)	10	12½	23/9	..	5 5 3
Henley's (5/–) ..	20	20	25/9	+3d.	3 17 6
4½% Pref. ..	4½	4½	23/–	..	3 18 3
Hopkinsons ..	15	15	57/–	..	5 5 3
India Rubber Pref.	5½	5½	20/–	..	5 10 0
Intl. Combustion	32½	30	6	..	5 0 0
Johnson & Phillips	15	15	66/–	+½	4 11 0
Lancashire Dynamo	20	20	4	..	5 0 0
Laurence,Scott(5/–)	15	12½	10/–	..	6 5 0
London Elec. Wire	7½	7½	30/–	..	5 0 0
Lucas, J.	15	15	70/–	+1/6	4 5 9
Mather & Platt ..	10	10	48/3	..	4 3 2
Met.Elec.CablePref.	5½	5½	21/3	..	5 3 6
Murex	20	20	5½	+½	3 12 9
Pye Deferred (5/–)	25	25	21/3	..	5 17 8
Revo (10/–) ..	20	17½	35/6	..	4 18 7
Reyrolle	12½	12½	65/–	+6d.	3 17 0
Siemens Ord. ..	7½	7½	31/–	..	4 16 9
Smith, S. (1/–) ..	50	37½	9/9	–3d.	3 17 0
Strand Elec. (5/–)	4	7½	7/3	+1/–	5 3 5
Switchgear & Cowans (5/–) ..	15	10	13/6	..	3 14 1
T.C.C. (10/–) ..	5	5	15/–	..	3 6 8
T.C. & M... ..	10	10	47/–	–1/–	4 5 1
Telephone Mfg.(5/–)	9	9	11/6	..	3 18 3
Thorn Elec. (5/–)	20	20	19/3	+3d.	5 4 0
Tube Investments	23¾	20	93/–	..	4 6 0
Vactric (5/–) ..	Nil	Nil	11/–	–6d.	—
Vickers (10/–) ..	10	10	20/–	..	5 0 0
Ward & Goldstone (5/–)	20	20	22/–	..	4 11 0
Westinghouse Brake	10	12½	64/3xd	+1/6	3 17 6
WalsallConduits(4/–)	55	55	42/6	..	5 3 6
West, Allen (5/–)	7½	7½	6/6	..	5 15 5

* Dividends are paid free of Income Tax.

Stocks and Shares (*Continued from page* 234)

105½. Nearly a score of preference shares in this group have risen 6d. apiece in the last few days. The 6 per cents. mostly stand at 32s. offering £3 15s. per cent. on the money.

In the overseas list, the Indian shares are noticeably good. Calcutta Trams at 21s. 6d. have improved by 1s. 6d.; Calcutta Electrics at 35s. and Cawnpores at 28s. show a rise of 6d. Tokyo Electric sixes went back to 19½. Dollar stocks are mostly lower. Canadian Marconis at 7s. 3d. have lost 6d. Cable & Wireless ordinary came to market, and lost 1½ points at 76½. Globe ordinary at 33s. and Marconi Marines at 32s. 6d. are 6d. better. Telephone shares maintain their ground. Speculative interest in radio shares has largely subsided, but E.M.I. rose to 22s. Sterling Industries preference went back to 10s. after being 11s. 6d.

Overseas

Mexican securities (and insecurities) suffered a setback from the announcement that the Mexican Government intend to increase, to a substantial extent, the taxation at present levied upon earnings. Attention has been drawn here on several occasions to the advances secured by Mexican Light & Power issues. The company's 5 per cent. first mortgage bonds rose last week to 100; on the taxation talk, the price has gone back to 97½ and other Mexican issues have reacted from their best. Falls have also occurred in Brazilian Tractions and a few other dollar stocks.

Foreign Affairs

Anglo-Argentine Tramway stocks have been an active market and at rising prices. Rumour has once more circulated the impression that the company may be able to make some distribution on its 4 per cent. first debenture stock. Enthusiasm goes so far as to hint at the possibility of a distribution on the 4 per cent. income debenture; as to the likelihood of this, the present quotation of 14 for the stock is sufficient commentary. Advices from Buenos Aires cannot be said to favour the idea that the company has emerged from its difficulties. Faith is certainly required to induce purchases of the stocks except as speculative propositions.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (1s. *each*) *may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2. The superseded application numbers are omitted except where specifications have been advertised in the Journal under those numbers as open to public inspection under Sec.* 91 (4) *of the Patents Acts.*

ABBEY (Wilson Welder & Metals Co., Inc.).—" Variable-reactance transformers." 9006. July 16th, 1941. (550696.)

Aktiebolaget Elektrolux.—" Absorption refrigerating apparatus." 4945/42. April 22nd, 1941. (550796.)

Arrow Electric Switches, Ltd.—" Push-pull electric switch." 8424/42. July 11th, 1941. (550797.)

N. J. Baldwin.—" Electric motor power drive units adaptable to different appliances." 4998. April 17th, 1941. (550687.)

British Thomson-Houston Co., Ltd.—" Domestic washing machines." 11963/41. September 19th, 1940. (550669.) " Electric motor control systems." 8910/41. July 13th, 1940. (550722.) " Fluorescent materials." 484/42. January 16th, 1941. (550744.) " Electric meters and instruments." 12784/41. October 4th, 1940. (550788.)

Cinema-Television, Ltd., and K. A. R. Samson.—" Cathode-ray tubes." 8918. July 15th, 1941. (550655.)

M. J. Cradick and Metropolitan-Vickers Electrical Co., Ltd.—" Manufacture of bonded electrical insulating material." 13587. October 22nd, 1941. (550760.)

D. G. Downes.—" Panel type of control means for railway signalling systems." 3239. March 10th, 1941. (550685.)

Favag, Fabrique d'Appareils Electriques Soc. Anon., and J. A. Dreyfus.—" Apparatus for the reception and/or transmission of electrical short waves." 10786. June 24th, 1940. (550774.)

General Electric Co., Ltd., H. C. Turner and J. Whiteley.—" Traffic signal lights." 13003. October 8th, 1941. (550735.)

Honeywell-Brown, Ltd. — " Differential pressure switch." 2071/42. April 3rd, 1941. (550767.)

Igranic Electric Co., Ltd.—" Printing presses comprising a plurality of printing units." 7724/42. June 7th, 1941. (550681.)

Igranic Electric Co., Ltd., and J. R. Taylor.—" Electric motor control systems." 12805. October 3rd, 1941. (550672.)

S. R. Keemle.—" Electro thermic reduction of volatile metals." 12154/41. September 23rd, 1940. (550732.)

Landis & Gyr Soc. Anon.—" Prepayment mechanism for meters." 13268/41. October 16th, 1940. (550789.)

O. A. McDowell and J. P. C. Done.—" Electrical water heaters." Cognate applications 9009/41, and 7033/42. July 16th, 1941. (550697.)

H. Martin and Murex Welding Processes, Ltd.—" Electric arc welding." 10720. August 22nd, 1941. (550727.)

Philips Lamps, Ltd. (Naamlooze Vennootschap Philips' Gloeilampenfabrieken).—" Pentode or like electron discharge tubes having suppressor grids." 10782. August 23rd, 1941. (550728.) " Mounting of indirectly heated cathodes for electron discharge tubes." 12157. September 19th, 1941. (550733.). " Circuit arrangements for the maintenance of the terminal voltage of electric apparatus supplied from a source of current of variable voltage." 14888. November 19th, 1941. (550743.) " Piezo-electric laryngophones." 9653. July 29th, 1941. (550756.)

B. H. R. Sandell.—" Electrically heated boiling, cooking and like apparatus." 2119. February 17th, 1942. (Convention date not granted.) (550747.)

Standard Telephones & Cables, Ltd.—" Radio communication system." 13287/40. October 11th, 1939. (550716.)

Standard Telephones & Cables, Ltd., and G. L. Ward.—" Electrically heated soldering apparatus." 9099. July 18th, 1941. (550704.)

Standard Telephones & Cables, Ltd., E. M. S. McWhirter and C. G. White.—" Emergency control of electrical switchgear." 2022. February 14th, 1941. (550749.)

J. Uhrich.—" Alarm clock electric switch." 12128/42. September 15th, 1941. (550682.)

United Insulator Co., Ltd., T. J. Rehfisch and T. R. Amschwand.—" Variable electric condensers." 7414. June 11th, 1941. (550777.)

Westinghouse Brake & Signal Co., Ltd., S. A. Stevens and A. H. B. Walker.—" Alternating electric current control apparatus." 7790. June 20th, 1941. (550653.)

Westinghouse Electric International Co.—" Damping of vibrations of audio-frequency." 14262/41. November 12th, 1940. (550761.)

Resistance of Wood

THE moisture constant of wood may be indicated by measuring the electrical resistance between two probes driven into a drying board. When the wood is heated at atmospheric pressure in a confined space, which is suddenly evacuated, the resistance will increase by a factor of as much as 200 to 1.

Consequential suggestion of rapid decrease of moisture content is only apparent; its non-reality prompts Messrs. W. W. Barkas, R. F. S. Hearmon and G. H. Pratt, Forest Products Research Laboratory, to suggest in *Nature* that the current path in moist wood is principally along the interior surfaces of the cells. If it were through the body of the cell walls, the sudden drying of the interior surfaces on evacuation could only cause an insignificant increase of average resistance.

The effect appears to be confined to initial moisture contents below 40 per cent., indicating that small local drying is able to reduce the moisture in surfaces without affecting the " free " water present in cell cavities. Since the temperature coefficient of the resistance is negative, conduction is probably ionic as in a solution, but it is too small to account in terms of local cooling for the large change of resistance on evacuation.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Belfast.—February 24th. Electricity Department. Stores, including electrical material. (February 5th.)

Birkenhead. — February 15th. Electricity Department. Electric lamps. (January 29th.)

Dundee.—February 15th. Public Health Committee. Electrical work at Gourdie Farm. Particulars from City Quantity Surveyor; tenders to Town Clerk.

Edinburgh.—February 15th. Gas Department. Electrically driven oxide disintegrator having a capacity of 10 to 15 tons per hour. Specifications from Engineer and Manager, Corporation Gas Department, 15, Calton Hill; tenders to Town Clerk.

Newcastle-on-Tyne. — Education Committee. Installation of electric lighting and cooking arrangements at various school kitchens. F. W. Harvey, Education Offices, Northumberland Road.

Orders Placed

Barrow-in-Furness.—Electricity Committee. Accepted. Switchgear: Two panels (£596); One kiosk housing a 3-panel switchboard (£1,113); One 3-panel switchboard (£822).—Ferguson Pailin.

Cardiff.—BATHS COMMITTEE. Accepted. Sound amplifying equipment (£125).—G.E.C.

Manchester. — Electricity Committee. Accepted. Vehicle batteries.—D.P. Battery Co., Ltd.

Southport. — Attractions Committee. Accepted. Overhauling electricity supply at sea bathing lake.—Brooks & Southworth.

Wallasey.—Electricity Committee. Accepted. Wireless apparatus for power station and sub-station.—Rediffusion, Ltd.

Watford.—Electricity Committee. Accepted. 100-kVA transformer (£140).—Brush Electrical Engineering Co., Ltd. Three oil-immersed circuit-breaker cubicles (£173 each).—J. G. Statter & Co.

Worcestershire.—Joint Committee. Accepted. Electric lamps for police stations.—Ensign Lamps, Ltd.

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Ashbourne.—Houses; D. Powell, surveyor, King Edward Street.

Bakewell.—Houses for R.D.C.; R. Hayhurst, surveyor, Council Offices, Bath Street.

Batley.—Extensions to maternity home, and wartime nursery; T. Mossop, borough surveyor, Town Hall.

Bexhill-on-Sea.—Completion of senior school; borough engineer.

Birkenhead.—Police box system (£6,000); borough engineer.

Birmingham.—School extensions (£4,547); city engineer.

Bolton.—Dairy, Wicken Lees Farm, Tempest Road; Col. James Carter.

Bromsgrove. — Huts, Stourbridge Road (£1,090); J. & A. Brazier, Ltd.

Chippenham.—Extensions at Isolation Hospital; Calne, Chippenham and Malmesbury Joint Hospital Board.

Eastwood (Notts).—Nursery (£2,157); Allcock & Siston.

Glasgow.—Four prefabricated huts of hall type as temporary school (£6,000); city architect.

Guildford.—Wartime nurseries; borough engineer, Municipal Offices, High Street.

Huyton.—Police station, King's Drive (£2,905); W. W. Kenny (Maghull), Ltd.

Ilford.—A.R.P. buildings, Clarks Road (£1,400); Haines & Warwick.

Nursery, Lichfield Road; borough engineer.

Kidderminster.—Reconstruction of four classrooms at Harry Cheshire Modern School (£6,500); J. Hawcroft, borough surveyor, Municipal Offices, Mill Street.

London.—DEPTFORD.—Nursery, Evelyn Street (£2,087); Kent & Sussex Contractors, Ltd.

ST. MARYLEBONE.—Shelters, Edgware Road and Balgrave Gardens (£3,000); White & Johnson, Ltd., and John Lewis Building, Ltd.

Manchester.—Central kitchen, North District, for school meals (£2,500); chief surveyor, Education Offices, Deansgate, Manchester 3.

Netherton (Northumberland).—Miners' canteen; Carse & Sons, Oldgate, Morpeth.

Newcastle-under-Lyme.—Fire station, control room and heating, at Wolstanton; Baddeley Bros., builders, 78, Dimsdale Parade, Wolstanton.

Nottinghamshire.—Shelters, Bingham, Radcliffe, Basford and Mansfield (£13,000); county architect.

Ossett.—Central school kitchen; borough engineer.

Renfrew.—Completion of 36 houses; burgh surveyor, Municipal Buildings, Renfrew.

Salford.—Nurseries (£1,787); D. Walton & Co., Ltd.

Smethwick.—Canteens (£1,800); J. Harper & Sons, Ltd., and Housing, Ltd.

Stafford.—Maternity home; W. Plant, borough surveyor, Borough Hall.

Surrey.—Nursery, site near West Ewell Station; county architect, Kingston-on-Thames.

Wallasey.—Nurseries, Oakdale Road (£2,092) and Central Park (£1,649); W. Bradshaw & T. Gallimore.